THE IRON TRADE REVIEW

XXXI. CLEVELAND, O. DECEMBER 1, 1898. CHICAGO, ILL. NUMBER 48

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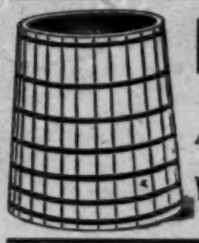

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THE IRON TRADE REVIEW

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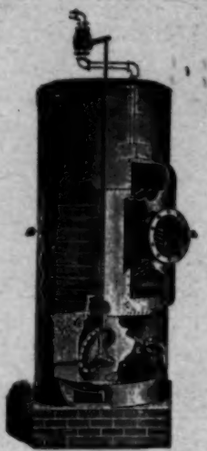

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THE IRON TRADE REVIEW

VOLUME XXXI. CLEVELAND, O. DECEMBER 1, 1898. CHICAGO, ILL. NUMBER 48

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Excepting the memorable break in the rail pool in February of last year, no such tonnage of steel rail sales has been closed in a single week as that just booked by the manufacturers. It includes 50,000 tons to the Illinois Central, 75,000 tons to the Chicago & Northwestern, 55,000 tons to the St. Paul, 25,000 tons to the Burlington, and large orders to Eastern and Central systems. What has been booked and what is practically closed amounts to more than 500,000 tons, of which the bulk has been taken by Chicago and Pittsburg. The failure of the rail manufacturers to agree upon the selling company scheme was followed by a conference of the Carnegie Steel Co., the Illinois Steel Co. and the Colorado Fuel & Iron Co., as noted in this column last week. An arrangement resulted, which promises to have better holding powers than the gentlemen's agreement in force previous to September. The prices fixed are $17 Pittsburg, $18 Chicago and $20 Pueblo. This is $1 a ton less for Pittsburg and $2 less for Chicago than the quotations made in the year preceding September. At so reasonable a figure the railroads were free to take hold, and with the mills now filled up far into 1899, there is little dissent from the opinion that the rail total for next year, adding exports, will be close to 2,000,000 tons. The agreement between the three mills named imposes no territorial restrictions upon sales, but business west of Pittsburg will be so divided for rolling that all the Central and Western plants will get the benefit of it. On the $17 basis, Pittsburg is in position to take its share of Eastern business, also. With the rail problem settled in a way that insures maximum purchases from the railroads, the entire trade is put at once on a strong footing for the new year. The better feeling in Bessemer iron and in steel billets, as noted a week ago, continues. With available Bessemer iron now more completely in the hands of the associated furnaces, and further sales in the week, the Pittsburg quotations is $10.35 to and $10.50. Billets are $15.25 to $15.50 at maker's mill, with the feeling general that prices for the first half of 1899 will be well maintained. The sheet and tin bar market shows greater strength, now that the tin plate consolidation is an assured fact. Northern sellers of foundry iron have been closing contracts for delivery through 1899 at substantially the prices made for current business, which in Central territory are nearly $1 a ton below delivered quotations on Southern iron. In the East, Pennsylvania and Virginia furnaces are making considerable sales, and unusual activity is noted for basic. In addition to good domestic sales Eastern furnaces have placed several lots of basic iron abroad. November shipments of foundry iron have been large and a further reduction of stocks is expected in the statement for the month. Reports from finishing mills the past week indicate that the nearness of the year's end is a factor in some lines. Structural business has slackened, though the mills are not yet as prompt with deliveries as they are likely to be a month hence. Sheets are weaker and mills anxious to take business find it necessary to make concessions. Orders for steel cars keep plate mills well booked ahead, added to vessel work, of which more has come up in the week, Chicago getting the business. Car orders are piling up business for the bar mills, axle forges and wheel foundries. In connection with the tin plate consolidation it is reported that orders have been given for a shut-down of all the absorbed plants for a week or 10 days prior to Dec. 15, and for their transfer on that date to the Consolidated Tin Plate Co.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World*, 705 PUBLICATION BUILDING, Nov. 30.

A fair degree of activity is maintained in the local iron and steel market. Export inquiry continues good. Railroads have extensive plans on foot for improvements and the steel trade will profit materially thereby. There has been great excitement in the rail market, the Pittsburg interest selling heavily. The conclusion of the tin plate combination is being effected. The concern will have only a branch office here. There is considerable talk of new tin plate mills, and foundrymen are busy figuring.

PIG IRON.—There is more firmness in the Bessemer pig iron market, and $9.80 valley furnace is now reported to be the bottom, with furnace quotations $9.85 to $10, valley, and the Pittsburg market $10.35 to $10.50. Sales of upwards of 30,000 tons are reported for the week. From the furnacemen's standpoint the outlook is for stronger prices after the opening of the year. In foundry iron there have been some fair sales, with prices for foundry as well as gray forge unchanged. We quote:

Bessemer, valley furnace	$ 9.80 to $10.00
Bessemer, Pittsburg	10.35 to 10.50
No. 1 Foundry	10.50 to 10.60
No. 2 Foundry	10.00 to 10.25
No. 3 Foundry	9.65 to 9.85
Gray Forge, valley furnace	8.75 to 8.85
Gray Forge, Pittsburg	9.25 to 9.30

BILLETS AND RODS.—The steel market is firmer than at last report, with promise of advance early in the new year. For the balance of this year $15.25 maker's mill, might be shaded a trifle. Sheet and black plate bars are firmer, the minimum for long lengths being $16, Pittsburg, while quotations run up to as high as $16.50 for cut bars. The supply has been somewhat limited owing to difficuly with the machinery at one of the mills which had already oversold. Rods are still quoted $20.50 to $20.75.

PLATES.—The market shows every indication of strength, although there is no change in quotations. The much-talked-of Coolgardie plate contract, involving 60,000 tons or more, still hangs fire. We quote: Tank, 1.15c; shell steel, 1.20c; flange, 1.25c; fire box, 2c and upwards.

RAILS AND TRACK MATERIAL.—Some heavy selling was done early in the week, the local interest booking a large tonnage,

presumably on a $17 basis. Eastern mills have quoted $18 at mill. It is understood that as the result of a conference on Wednesday, Nov. 23, the Carnegie Steel Co., Federal Steel Co. and Colorado Fuel & Iron Co. have entered an arrangement for business west of Pittsburg, prices being fixed at $17 Pittsburg, $18 Chicago and $20 Colorado mill. Quotations on girder rail are withdrawn and meantime it is reported some agreement is being arrived at by the three mills in this trade. Track materials continue in good demand, and we quote: Spikes, 1.45c; track bolts, 1.65c to 1.70c; splice bars, 1.10c to 1.15c; links and pins are quoted from 1.20c to 1.27½c.

SHEETS.—The sheet market has weakened still further for both spot and future delivery. For December, 1 85c can be done on No. 28 common, while for the first quarter of next year as low as 1.90c is named, few mills quoting higher who want the business. Galvanized sheets have not followed black, and are measurably firmer at 80 and 7½ per cent off, with a 15-cent freight allowance.

FERRO-MANGANESE AND SPIEGEL.—There is no change in these lines. Ferro-manganese is quoted at $50 for 80 per cent domestic, and spiegel at $23.50 and $24, though the lower price may be shaded in some quarters.

IRON AND STEEL SKELP.—This line remains without notable change, the market being not over-strong. We quote: Grooved iron skelp, 1.07½c to 1.10c; sheared iron skelp, 1.20c to 1.22½c; grooved steel skelp, .97½c to 1.05c; sheared steel skelp, 1.10c to 1.12½c.

PIPES AND TUBES.—The market is maintaining its position satisfactorily, most of the mills being well filled to the end of the year, with considerable inquiry going the rounds for prompt shipment. The outlook for next year is good. We still quote additional discounts six tens for less than carload lots, and six tens and five for car loads. Base discounts are: Butt weld, black, 55 per cent off; lap weld, black, 65 per cent off; butt weld, galvanized, 47½ per cent off; lap weld, galvanized, 52½ per cent off. Discounts on merchant boiler tubes are as follows: 2¼-inch and smaller, 72½ per cent off; 2½ inch and larger, 75 per cent off. Inserted joint casing is now quoted at 60 off and screw and socket joint casing at 60 and 10 per cent off.

STRUCTURAL MATERIAL.—The structural market is holding up fairly well considering the lateness of the season. Some of the mills still find difficulty in making prompt deliveries. Quotations remain: Beams and channels, 3 to 15 inches, 1.20c; 18 to 24 inches, 1.30c; tees, 1.25c; zees, 1.20c, and angles, 1.10c. Universal plates are generally quoted at 1.10c but some firms are holding for 1.15c and are getting business.

SPELTER.—The spelter market is very firm. The price delivered, Pittsburg, is now 5.25c to 5.30c, the lower figure being difficult to secure. In view of the fact that the London market has advanced to £24 12s. 6d. there is no likelihood of any weakness immediately.

OLD MATERIAL.—The market is a trifle firmer, with old steel rails quotably higher. We quote: Old steel rails, long lengths, $9 75; cut, $10 to $10.25; old iron rails, $13 75; wrought iron scrap, $11.50, net valley; cast borings, $6; busheling scrap, $9, net; car wheels, $10.25, gross; cast scrap, $9 gross; iron axles, $6, net; steel axles, $12 50, gross; charcoal scrap, $10, gross; wrought turnings, $6.75, net, valley.

CHICAGO.

OFFICE OF *The Iron Trade Review and Industrial World*, 1522 MONADNOCK BLOCK, Nov. 30.

Various rumors are heard regarding the arrangements of the rail makers, but the facts seem to be about as follows: The Federal Steel Co., the Carnegie Steel Co., and the Colorado Fuel & Iron Co. have entered into an arrangement which provides for an agreed price at Pittsburg, Chicago and Colorado, and for a division of the tonnage, but not of territory. The mills can all sell in any territory, but regardless of the tonnage of the sales of each mill, will only secure a certain proportion to roll. Prices have been agreed upon at $17, Pittsburg; $18, Chicago, and $20, Pueblo. The agreement was reached at a meeting held in New York last week Wednesday, at which the three mills were represented. No other mill has been taken into the combination. Sales in the Western territory have already been very heavy, including one of 50,000 tons to the Illinois Central, and another of 25,000 tons to a Western road. Both of these sales were made by the Illinois Steel Co. General business in the week has been excellent, and in some lines large tonnages have been closed. The market is strong in nearly every line, the only weakness being in a few finished shapes, and this is caused not by a lack of business, but solely because buyers are slow in making specifications on contracts at this late season of the year. Many consumers, at this time, postpone taking in material until after the first of the year, to simplify stock taking and the financial matters of the year's end.

PIG IRON.—Sales were hardly as large last week as in the week previous but still were very satisfactory. The furnaces, both North and South, maintain a firm front and refuse to make concessions to secure business. Notwithstanding this, many buyers who have found that their needs would have to be filled immediately have placed orders, and have paid the full prices asked. There is a disposition on the part of a few buyers to hold off in the expectation that lower prices will be made next year, but the majority of them are willing to pay the present prices and do very little bargaining. There are in the market at present several inquiries of considerable size, which are expected to be placed within a short time. Altogether the situation is about as good as could be expected at this season of the year, which is usually quiet. No changes have been made in quotations.

Lake Sup. Charcoal	$11 50 @ $13 00	Southern Coke No. 3	$10 35 @ 10 60
Local Coke Fdy. No. 1	11 50 @ 12 00	Southern No. 1 Soft	10 85 @ 11 10
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Local Coke Fdy. No. 3	10 75 @ 11 00	Southern Silveries	11 25 @ 11 50
Local Scotch Fdy. No. 1	11 50 @ 12 00	Jackson Co. Silveries	12 50 @ 14 50
Local Scotch Fdy. No. 2	11 00 @ 11 50	Ohio Strong Softeners	12 00 @ 13 50
Local Scotch Fdy. No. 3	10 75 @ 11 00	Alabama Car Wheel	15 00 @ 16 00
Southern Coke No. 1	10 85 10	Malleable Bessemer	11 50 @ 12 00
Southern Coke No. 2	10 60 @ 10 85	Coke Bessemer	11 50 @ 12 00

BARS.—Considerable business was done last week, most of it in small lots although one or two good sized contracts were closed. A number of good orders are being figured on at present, and will likely be closed immediately. The market for iron bars is about as last week, most business, in small lots, being taken at 1.05c, but large orders and those of favorable specifications are going at something less than this. Some business has been closed as low as 1c, but this is exceptional. Steel bars are hardly as strong as they were two weeks ago, sales having been made in the past week at 1.05c, Chicago. A few mills are still asking 1.15c for billet steel, but this is a high price.

RAILS AND TRACK SUPPLIES.—The situation in the steel rail market is outlined at the head of this column. The agreement is now in full force and with the low prices named by the mills a very large business is expected to be closed. Buying started in as soon as the arrangement of the mills was concluded, and a very heavy tonnage was closed within a short time thereafter. In addition to the two lots named above, of 50,000 and 25,000 tons, placed in this market, considerable orders have been received from other roads. Quotations are now made as follows: Standard section rails, $18, Chicago; light rails, $20 and upwards; steel splice bars, 1.15c to 1.25c; track bolts with square nuts, 1.80c to 1.90c; hexagon nuts, 1.90c to 2c; spikes, 1.55c to 1.60c.

BILLETS AND RODS.—There has been no change in the situation and no sales of either billets or rods in this market in the week. Prices are nominal at $16.50 for billets and $22.50 for rods.

CAR ORDERS.—The Pennsylvania system is understood to have placed orders for 7,000 cars within the past week, dividing the business among several of the car works, the large proportion of it going to Western concerns. The New York Central has placed 5,000 cars, entirely with Eastern car works. One or two other orders of good size were placed last week. The car works in this territory are full of business, and could accept very little more for some time ahead. Car material is in large demand, and sales of bars, axles and axle billets are large.

STRUCTURAL MATERIAL.—General business has been very good, although no large contracts were placed last week. Considering the season of the year, the tonnage being placed is remarkably large. The market is very firm, and our quotations are shaded in very few instances. Prices are as follows: Beams, 15 inch and under, 1.35c to 1.40c; 18-inch and over, 1.45c to 1.50c; angles, 1.25c to 1.30c; plates, 1.20c to 1.30c; tees, 1.40c to 1.45c; zees, 1.35c to 1.40c. Small lots from stock are quoted at ¼c to ½c higher.

PLATES.—There continues to be a very heavy demand for

plates of all kinds. Business last week was excellent, including several large orders, among them one for 3,500 tons of ship plates, placed by the Chicago Shipbuilding Co. with the local mill. A number of good inquiries are in the market at present. Some of the Eastern mills are out of the market, not being able to make deliveries on new business earlier than March. Quotations are made as follows: Tank plates, 1.20c to 1.30c; flange steel, 1.30c to 1.40c; firebox steel, 1.85c to 5c.

SHEETS.—There continues to be a good demand for both black and galvanized sheets, and sales last week were excellent, including several quite large orders of both varieties. The market is firm at 2c to 2.05c for No. 28 black and 80 and 7½ per cent discount for galvanized.

MERCHANT STEEL.—Considerable tonnage was placed in this market last week. The bulk of the business was in comparatively small lots, but several good sized contracts were included in the week's business. Quotations follow: Open-hearth spring, tire and machinery steel, 1.65c to 1.75c; smooth finished machinery steel, 1.60c to 1.70c; smooth finished tire, 1.50c to 1.60c; tool-steel, 5 50c to 7.50c; specials, 11c and upwards.

SCRAP.—The market has been quiet, with only small sales of any kind of scrap. There is some demand for old iron rails, and one sale of fairly good size was made last week. Dealers' selling prices are as follows:

Old iron rails, gross	$12 50@$12 75	Axles, net	$14 25@$14 75
Old steel rails, long, gr.	10 50@ 11 00	Cast borings, net	4 25@ 4 50
Old steel rails, short	8 75@ 9 00	Wrought turnings, net	6 00@ 6 50
Old wheels, gross	11 00@ 11 50	Axle turnings, net	7 00@ 7 25
Railroad forge, net	11 50@ 12 00	Mixed steel gross	7 45@ 7 50
Dealer's forge, net	10 00@ 10 50	Stove plates, net	5 75@ 6 00
No. 1 mill, net	7 50@ 8 00	Heavy melting stee,gr.	8 25@ 8 50
Heavy cast, net	8 50@ 9 00	Old iron splice b., net.	12 75@13 00
Malleable cast, net	8 00@ 8 50		

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., Nov. 30.

As ore shipments draw toward the end, the fact is appreciated that the stockpiles at Lake Superior iron mines, some of them dating one, two and three years back, have been a far more important factor in the year's business in ore than any one in the trade would have been inclined to predict six months ago. Looking toward 1899, with no such accumulations to draw on, it is evident that the question of an adequate supply of labor will figure largely. The copper country is now competing with the iron ranges for miners, and the higher wages announced at several iron properties in the past week tell the story of the new relation between labor supply and demand. The price of ore for next year thus promises to rule higher, apart from any agreement among producers. There is greater activity than in years, in the looking up of partly developed properties and in diamond drill work by well established companies, though the consensus of authoritative comment in the trade is that whatever advance is made must be moderate,—only sufficient, according to the ideas of some, to cover advances in cost, in the case of Bessemer ores. The non-Bessemer situation is another story; it is a question there of compensating for the undue generosity of producers in a year that could have yielded a fair profit but did not. In the past week transportation arrangements have been made for several lots of ore recently sold, to come from Escanaba. Shipments there will continue for some time, possibly a week or 10 days. From Two Harbors final cargoes of Vermilion and Mesabi ores are to be brought down by the Minnesota fleet, the ore to be held in the vessels through the winter at Lorain, for early spring use at the new furnaces.

PIG IRON.—The higher price asked for Bessemer iron, as noted one week ago, is being maintained, and the furnaces hold a stronger position than for some time. We quote $9 80 to $10.00 in the valley and $10.35 to $10.50 Pittsburg for delivery in the first quarter of 1899. There is no disposition to make sales reaching into the new ore year. Some business has been done in a scattering way, the past week, but larger buying is considered not far distant, for delivery in the Pittsburg district. The list of active valley furnaces was increased this week by the blowing in of the Mary at Lowellville, after repairs giving a considerable increase in capacity. Foundry iron shows a very satisfactory movement, requests coming in some cases for larger shipments than called for by contracts. New sales are being made with every week, transactions since the last report ranging from 200 and 300 to 800 tons being negotiated through Cleveland offices. Foundry furnaces in valley and Buffalo districts have closed up a good tonnage for 1899 in the last half of November, and indications are that a good buying will mark the month of December, though shipments may decline a little in view of inventories. The feeling is firm and quotations are $9.50 to $9.75 for No. 2 at furnace. Forge iron is quiet, at $8.75 valley furnace. Charcoal iron furnaces are making their best outputs and are steadily shipping the iron. We quote f. o. b. Cleveland:

Bessemer	10 40@10 55	Valley Scotch No. 1	$10 40@10 50
No. 1 Strong Foundry	10 40@10 65	Valley Scotch No. 2	10 15@10 40
No. 2 Strong Foundry	10 15@10 25	Gray Forge	9 40
No. 3 Foundry	9 65@ 9 90	Lake Superior Charcoal	11 50

FINISHED MATERIAL.—There is a slight slowing down in some lines, due to winter and the approach of stock-taking. Structural material shows the effect of the season, but even here mills are unable to make deliveries short of two weeks. The two vessels figured on by the Minnesota Steamship Co., a steamer and consort, have been placed with Western builders and the material was bought through Chicago. Car business is furnishing some good tonnage, but the bulk of the current business coming to the mills is the aggregate of the manifold wants of scattered consumers. In steel bars, for example, the smaller sizes are much in demand, indicating a large consumption for bolts, nuts and other lines in which activity is an index of well diffused consumption. On specifications calling largely for these sizes bar mills are holding for 1c Pittsburg. Bar iron is still quoted 95c valley mill. Plate mills are well sold, for weeks ahead in most instances, and those able to take business for December delivery are asking 1.15c Pittsburg as minimum and in some instances 1.20c. Wire and wire nails are unchanged in demand. Prices are somewhat flexible. We quote nails at $1.30, Cleveland mill, which could be shaded on large lots; wire is $1.15 for smooth, and $1.40 and $1.70 for barbed.

CINCINNATI.

Nov. 29.

The Southern market affords very little variety these days. The situation has remained practically unchanged during the past two months. The Birmingham iron masters are confident of the strength of their position and they are making no concessions, still believing that the market will come to them eventually. They are selling iron for export at better prices than are obtained for domestic consumption even at full present schedule figures. There is no furnace in the South that is accumulating any iron. It is probable there has been a little livelier inquiry during the past 10 days and one or two fairly good sales have been made, but as yet there is nothing that has even the appearance of a buying movement. Buyers are taking deliveries liberally and urging forward shipments on orders already booked. One of the conspicuous features to-day is that the railroads are buying cars more liberally, and many of the car works are so well supplied with orders that they are not able to take on any new ones. As evidence of the general activity in the trade, the coke companies of the respective districts are scarcely able to meet the requirements for coke, and the short car supply is being felt in every coke center. We quote for cash f. o. b. Cincinnati: Southern Coke, No. 1 foundry, $10 to $10.25; No. 2, $9.75 to $10; No. 3, $9.25 to $9.50; No. 4 and gray forge, $8.75 to $9; mottled, $8.75 to $9; No. 1 soft, $10 to $10.25; No. 2, soft, $9.75 to $10; Hanging Rock charcoal, No. 1, $14.50 to $15.50; Jackson Co. silvery, No. 1, $12 to $12.50; standard Georgia car wheel, $14.25 to $15.

BUFFALO.

Nov. 28.

The situation as to supply and demand in local pig iron circles will ease up considerably with this week because of the closing of the canal, all energies having been bent recently to getting off the last water shipments of the season. The year 1898 has probably witnessed the largest movement of pig iron by the canal route in the history of that waterway. The demand continues fairly good, with a noticeable increase in the inquiry for forward deliveries, looking towards the placing of contracts for the winter and spring months. Prices are firm and full at the quotations given below, which are on the cash basis f. o. b cars Buffalo: No. 1 strong foundry coke iron, Lake Superior ore, $11.50; No. 2, $10.75; Ohio strong softener, No. 1, $11.50; No. 2, $10.75; Jackson County silvery, No. 1, $14; Southern soft, No. 1, $11.75; No. 2, $11.50; Lake Superior charcoal, $12 to $12.50; coke malleable, $10.75.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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FOREIGN PHASES OF OUR IRON EXPORTS.

An American metallurgical engineer who recently visited Europe found in Germany a very lively interest in the iron and steel export trade of the United States. A manufacturer of wrought pipe made particular inquiry about the ability of our pipe and tube manufacturers to continue to sell at the prices at which wrought pipe from the United States had been put upon the German market in the few months preceding. "If your manufacturers can make a profit on such prices," said he, "we may as well look for other business." Similar testimony is contained in a letter received by a Philadelphia gentleman from a fri nd in Berlin, and quoted from in the *Bulletin*. The writer says American competition is growing to be more and more of a bugbear to German manufacturers and that there is talk of combinations for self-protection. "Only a day or two ago it was announced that the manufacturers of rolled iron piping had been forced to make a cut of 3 marks per 220 pounds on their goods in order to meet American competition, offers having been sent in for certain contracts from American representatives in Hamburg that dazed German producers." We cannot find in the export statistics any encouragement to the foreign manufacturers of pipe. In September the shipments from this country were valued at $331,781, more than double the $147,990 total for September, 1897, and the greater part of this was wrought pipe. For the nine months ending September 30, these exports were valued at $3,188,186, three-fourths as much as the value of all the steel rail exports from this country in the same period. It can be seen that the efforts of the manufacturers of wrought pipe, who were among the pioneers in the export trade have been rewarded with a steady increase in foreign business. Those of them who have ore supply, blast furnaces and steel works back of them, and the best pipe mill equipment in the world, are not borrowing any trouble a out the inability to meet foreign producers in their own market. In the case of Germany the tariff i something of a bar, but while it remains on the present level it will not prevent profitable business by American pipe interests.

An English contemporary is responsible for this comment on the British foundry iron trade in which Southern producers have been something of a factor. It is interesting at least:

When, little more than two years ago, the pig iron makers of Alabama made up their minds to have a try for the markets of Europe, they were almost necessarily for a time literally and metaphorically at sea. They did not fully recognize the conditions that they had to meet, nor understand the special wants, and probably the particular fads, of the British iron founder. The last two years, however, appear to have taught them that what they originally looked upon as a mere experiment, founded more or less on bluff, and remarkable for its audacity, has proved the possibilities of an important permanent trade, subject to taking care to supply exactly the right description of iron for different purposes. At the outset of this business, the Alabama makers only guaranteed one thing—that their iron was good—quite as good as similar brands of Cleveland iron. But it has been complained that for a time, at least, there was no effort on the part of sellers to suit the grade to the wants of the consumer. This often led to confusion. One founder in Warrington is reported to have said that he bought a certain brand of Southern iron on the representation that it was a soft iron. He made light, ornamental castings, and needed a hot iron, very fluid, and not especially strong, to take a clear, sharp impression in the molds, but he was sold a grade that is fitted for the making of cast iron pipes instead. The chief characteristics of English foundry pig iron, with which American iron now competes, are higher silicon, higher phosphorus, and less metal. This gives a softer and a weaker iron. English founders, as a rule, like a fluid running iron, irrespective of strength or body. This they get by using the high phosphorus pig of Middlesbrough and Lincolnshire, which contain above one per cent, and of course such a pig is usually cold short, but this does not appear to give much trouble.

It will be news to founders on this side the water, and no doubt to furnacemen who have been studying the wants of the British trade, to hear that a preference for a "fluid running iron, irrespective of strength or body" is particularly characteristic of the English founder. One would have supposed that, like American founders, or like Americanized British founders, of whom there are not a few, he would use such an iron for fine, detail work, not calculated to bear weight or stress; but that for heavy machinery, for cylinders and for the lines of work calling for close grain and resisting power, iron would be chosen that would give the desired properties in the casting. We opine that English foundrymen will not fancy being credited with a weakness for "softer and weaker irons;" certainly they will not take pains so to advertise themselves with their customers or their friends, the inspectors. The instance cited in the paragraph we quote affords no basis for generalization. No doubt it has happened before that iron has been received that was not adapted to the work of the buyer. Such mistakes occurred in the English iron trade, we venture to say, before Southern iron ever entered it. The incident may illustrate what experience on this side is constantly emphasizing, that chemical analysis is a very desirable basis on which to buy and sell foundry iron; but it is an egregious error to base on a single case conclusions as to the adaptability of Southern iron to the needs of English founders. Both as to silicon and phosphorus, saying nothing of "less metal," it can be supplied in grades that will meet all the demands that are attributed to the British foundry trade in the strange paragraph we quote.

EVEN with high ocean freights, Alabama iron can be put down at British ports at a profit and still undersell the furnaces on the other side. A late Manchester market report says:

Makers of Middlesbrough iron are almost out of the market and the present corner in warrants almost precludes buying out of stores. Delivered by rail Manchester it would be difficult to buy good named foundry brands from makers under 53s. 10d. to 54s. 4d. net cash. Of Scotch iron there is so little either at the Mersey ports or the Manchester docks that there

are very few sellers who are prepared to quote, and prices are irregular. Glengarnock ranges from about 54s. to 54s. 6d., and Eglinton from 54s 6d up to 55s net, with American pig iron now quoted 49s. to 50s. delivered Manchester Docks.

The English and Scotch markets have been strengthening on foundry iron for several months, apart from the "corner" on Cleveland warrants. Scotch warrants at Glasgow were quoted 49s. 8½d. last week, as against 45s. 8½d. for the corresponding week of last year, an advance of $1. In hematite warrants, West Coast, the present quotation is 55s. 6d. as against 47s. 2½d. a year ago, an advance of $2. This means about $4 above the price of Bessemer iron at valley furnace. Under specially favoring freights, such as were had for a part of last year on steel out of Pittsburg, this opens a possibility for exports of Bessemer iron, and this may be a later development. But iron exports will only thrive when more vessel room is provided. There is an evident shortage of ocean carrying capacity, and the shipyards have a long season of prosperous operation before them in supplying the deficiency. The great drawback to the Birmingham furnaces to-day, with plenty of foreign business offering, is the scarcity of bottoms at any price. American-built vessels, operated by American companies, are the one great need.

THE article by Mr. Ulke on other pages of this issue presents the results of recent practice in the production of gun iron and semi-steel in the foundries of the United States. As the circle of works undertaking ordnance contracts has widened in the past year, the demand has increased for information concerning what has been but a by-path in American foundry practice. And since this line of work is to have increasing prominence in our enlarged programme of National defense and offense, this new contribution to the literature of the subject is timely. More and more are foundrymen seeking, by the application of rational and scientific methods, to secure uniformity of results, particularly in those classes of castings calling for special strength. Mr. Ulke's suggestion that foundrymen study to extend the use of gun iron and semi-steel is valuable, in a day when the product of the open-hearth furnace is making evident encroachment upon the domain of the cupola. Foundrymen, too, who have been looking with some concern upon the increasing competition in the beaten paths of production, may find in this suggestion the impulse to effort in other lines which call for the highest skill and the closest study of the metallurgical side of their business.

Personal.

P. P. Mast, the millionaire implement manufacturer of Springfield, O., who died last week, left to Ohio Wesleyan University property valued at upward of $200,000 and to the Methodist Episcopal Church property worth nearly $50,000. To his adopted children was given about $1,000,000.

President W. T. Graham, of the Ætna-Standard Iron & Steel Co., Bridgeport, O., is quoted as saying that he is not a candidate for the presidency of the tin plate consolidation, and that it is the expectation of the manufacturers that D. G. Reid, of Chicago, treasurer of the American Tin Plate Co., will be elected.

J. G. A. Leishman, formerly president of the Carnegie Steel Co., now minister to Switzerland, is visiting in this country.

Charles Hoefinghoff, president of the Hoefinghoff & Laue Foundry Co., Cincinnati, died on Nov. 20.

H. M. Curry, of the board of managers of the Carnegie Steel Co., Ltd., left for California last week with his family, to spend the winter.

Matthew Morton, president of the Morton Mfg. Co., Muskegon, Mich., has returned from a European tour on which he closed considerable business.

Oscar Seldis, mechanical and electrical engineer, of Boston, died of pneumonia Nov. 13, after a short illness. He was born at Berlin, Germany, in 1860 and was a graduate of a technical college in Berlin. He was with the Krupp Gun Works, Essen, for two years; with Meissner, manufacturer of mathematical instruments; also with the Anglo-American Brush Electric Light Corporation. He had traveled extensively in England, Holland and Russia. While in the United States he did valuable work for the General Electric Co. in Lynn, Mass., for the Goodyear Shoe Machine Co., of Boston, and was at the time of his illness with the Eppler Welt Machine Co., of Boston. Mr. Seldis had taken out three patents in Germany, the first for an electric switch, when he was 18 years old; another for a drawing table, and a third for the tool holder, which was published in the Nov. 10 issue of *The Iron Trade Review*.

Charles F. Rand, president of the Spanish-American Iron Co., sailed for Santiago de Cuba by the steamship Admiral Dewey on Nov. 24.

John Laird, a veteran iron founder of Canton, O., is dead at the age of 93.

Publications Received.

The first calendar of the season comes from Rogers, Brown & Co., the well-known pig iron sales agents. Their calendar for the coming year is fully up to the standard established by them in previous years. The design is artistic, the prominent feature being the face of a typical molder against a red flame.

The Jeffrey Mfg. Co., of Columbus, O., has recently taken up the manufacture of the Columbian separator screen and bolter, of which a circular has just been issued. The manufacturers advise us that they have erected an experimental machine at their works for the testing of such material as may be sent them for that purpose. Persons interested in the screening or separating of cement, cement clinker, ores, phosphate rock, marble, fertilizer materials, bone ash, plaster of Paris, sand, coal, earth, clay, etc., can secure data from the manufacturers.

J. J. Ryan & Co., brass founders, 68 to 74 W. Monroe st., Chicago, have just issued a very attractive descriptive pamphlet of their plant. It is printed on heavy, rough, green paper, with half-tone prints on coated paper pasted on every alternate page. The pamphlet contains 10 leaves, bound with green silk ribbon. The illustrations show different departments of the works, including part of the molding department, with 3,000-lb. ladle and crane; two batteries of furnaces; the finishing departments; three groups of castings, heavy, light, and fancy, and an illustration of the Babbitt metal made by the firm. Arguments are advanced in the reading pages, why J. J. Ryan & Co. are "as good as the best" makers of brass and bronze castings.

A late catalogue of the Cincinnati Milling Machine Co., Cincinnati, O., is devoted to this company's universal cutter and tool grinder. Half-tone cuts are given, showing some of the work done on this machine, and several pages are devoted to more or less common examples of grinding, with directions for doing the work most efficiently and with a view to the longest life of the tool.

A pamphlet issued by the Pneumatic Engineering Co., 100 Broadway, New York, gives interesting details of a new system of pumping by compressed air under the patents on a compound direct-air pressure pump, issued to E. G. Harris, C. E., professor of civil engineering in the School of Mines of the University of Missouri. The pump is of the class in which the liquid is taken into an air-tight vessel and then driven out by the application of compressed air directly to the surface of the liquid. The system is particularly advantageous when the water is distant from the source of power, as in mines and wells, or where, with a power plant already installed, it is desired to get water from a distant point. The compressor is the Rand Drill Co.'s.

THE usual bi-monthly conference was held at Youngstown last week between representatives of the bar iron manufacturers' association and the Amalgamated Association to fix wages of puddlers and finishers for November and December. The sworn returns of the manufacturers showed that there was no basis for a change in wages.

THERE has been active trading in basic iron in the East recently. Some large blocks have been taken, including a 10,000-ton lot of basic iron, and, what is specially important, two 1,000-ton lots from Lehigh furnaces for immediate export. A 5,000-ton lot of basic from a Virginia furnace has also been taken on foreign account, subject to freight to a Mediterranean port being secured within about 10 days' time.

MAKING OF GUN IRON AND SEMI-STEEL.

BY TITUS ULKE, M. E.

In treating of this subject, the writer disclaims any intention of going into it exhaustively, and will merely state the results of his personal experience, some of it of recent date, in the Government inspection of gun iron and semi-steel castings and their mode of manufacture. These notes are presented with a view to clearing up in part, at least, the fog of mystery generally found surrounding this very interesting subject. It is a well known fact that in the manufacture of United States gun and mortar carriages, gun iron, designated as cast iron No. 2, or its accepted equivalent, semi-steel, is largely used. The material thus employed must fulfill the requirements of the following specifications:

"It shall represent a high quality cast iron known as charcoal iron [the specifications should here be amended to include semi-steel, as this material is accepted as cast iron No. 2 by the Ordnance Department, althongh it is not necessarily a charcoal iron] prepared in an air furnace, or by such other process as will give an elongation of not less than 0.25 of one per cent under stress before rupture.

"To test this elongation, separate cylinders 20 inches long by 9 inches diameter, with a 2½-inch axial core, should be taken, one from each ladle of cupola iron, so as to represent fairly the iron in the casting itself. From these cylinders specimens shall be prepared with stems 10 inches long by 1.129 inches diameter."

These tests to be in addition to those prescribed for determining the tensile strength, which are cylindrical specimens provided with heads and having short stems 1.129 inches in diameter. They are sliced off or cut from the coupons cast on the pieces tested, the size of coupons ordinarily used being about 8 inches long by 3½ inches square, if the castings they represent are 3½ inches thick. Generally speaking, the coupon should be attached tangentially or with one side (full length) on the thickest section of the casting tested, if this be convenient, and should possess the same thickness as the casting, in order to secure a fair sample and in order to prevent the metal in the coupon from "drawing away" from the casting and leaving the latter unsound. The coupon should furthermore be wide enough (3½ to 4 inches wide) to allow the securing of at least two test specimens from the coupon and long enough (say eight inches), to permit the good gripping of the specimens by the wedges or threads in the testing machine. In general each of the more important pieces should be tested in three places, and pieces of less importance in one or two places, while minor pieces may be represented by heat tests.

The cast iron No. 2 must show a tensile strength of at least 28,000 and not more than 39,000 lbs. per square inch. If the specimen tested does not fulfill this condition, but shows a tensile strength of at least 25,000 lbs., an additional specimen may, at the request of the manufacturers, be taken from the vicinity of the first specimen, and if the mean of the results of the tests of these two specimens shows a tensile strength of 28,000 lbs., or at least 27,500, the test shall be regarded as satisfactory. If the first specimen shows a tensile strength lower than 25,000 lbs., two additional specimens may, at the request of the manufacturers, be taken from the vicinity of the failing specimen, and if each of these two specimens shows a tensile strength of 28,000 lbs., the test shall be regarded as satisfactory. The specific gravity of pig iron is about 7.00, and its tenacity about 16,000 lbs. to the square inch; but when suitably remelted, the specific gravity is increased between 7.2 and 7.8, and the tenacity about doubled.

Strong castings, fulfilling the above Government requirements, can be produced by remelting gray pig (to which scrap steel is sometimes added) in cupolas or air furnaces, and in three principal ways: First. In air furnaces, with a charge consisting mainly of charcoal iron (for example 35 per cent) and charcoal iron scrap (40 per cent), together with some coke iron (25 per cent). Second. In cupolas, with a mixture consisting chiefly of charcoal iron (40 to 80 per cent) and gun iron scrap (20 to 50 per cent), to which is sometimes added 20 per cent coke iron and 10 per cent of steel scrap. Third. In cupolas, with a charge consisting mainly of coke iron (60 per cent) and steel scrap (40 per cent), producing so-called "semi-steel."

It is always necessary to melt as quickly as possible, and with the least consumption of fuel. This usually requires artificial blast. Let us now briefly examine the characteristics of the above processes:

1. Air furnace castings, weighing from 2 to 18 tons, are made for the United States barbette and disappearing gun carriages by the Lorain Foundry Co., at Lorain, O. A sample furnace charge for a 12-inch barbette carriage base-ring (weighing over 17 tons) is as follows:

Charcoal iron scrap	35 to 45	per cent.
Cold blast charcoal iron (Vesuvius and Salisbury)	10 to 20	"
Warm blast charcoal iron (Rome and Pine Grove)	15 to 25	"
Coke iron (Napier, Dover, etc.)	20 to 35	"
	39,000 lbs.	

The gun iron thus obtained has the following composition: Si., 0.91 per cent; P., 0.44 per cent; S., 0.05 per cent; Mn., 0.31 per cent; Graph. C., 2.40 per cent; Comb. C., 0.63 per cent. (Average of 15 analyses kindly furnished to the writer by the Lorain Foundry Co.) Its average tensile strength is 31,350 lbs., per square inch.

Air furnaces are principally used for the production of very large castings and are specially adapted to all such as require great strength. Their use is sometimes necessitated if the fuel at disposal contains sulphur. The furnace is a reverberatory, built of fire brick bound strongly together by iron bars or plates; the hearth is of refractory brick covered with a thick layer of fire-sand; the grate is large, that a great volume of flame from the fuel may be drawn over the bridge and through the furnace, and for this purpose the chimney is made very tall when no artificial blast is used.

The dimensions of the furnace depend chiefly on the charge of iron and quality of the fuel. They are of correct proportions if a nearly uniform temperature be produced in all parts of the furnace. Unlike the cupola, this furnace allows the iron to be kept liquid for any length of time, and as the fuel is not in contact with the metal, and carbon and silicon are removed by the air, a somewhat stronger iron results. It is possible to make tests of the melted iron before casting and add, if necessary, materials to alter the nature of the iron and adapt it to the particular requirements of the casting to be made. Furthermore, very heavy scrap may be used, single pieces weighing as much as 15,000 lbs. having been melted in such a furnace for gun carriage heats. On the other hand, the air furnace does not admit of constant casting, i.e., a continuous supply of iron, and involves a greater loss of metal (between 7 and 10 per cent) by oxidation; owing to these circumstances and to the greater consumption of fuel, such furnaces are used only in large foundries, and whenever practicable, are replaced by cupolas of large size.

2. Cupola charcoal gun iron, for chassis rails, base-rings, hydraulic cylinders and other parts of disappearing gun carriages, is made at the Niles Tool Works of Hamilton, O. The following mixture is used:

No. 3 Muirkirk charcoal iron	5 to 15	per cent
No. 4½ Muirkirk charcoal iron	3½ to 15	"
No. 4 high Landon charcoal iron	25 to 30	"
No. 4 low Landon charcoal iron	30	"
Gun iron scrap	20 to 25	"
Total	100	per cent.

The gun iron obtained by this formula has the following composition: Si., 0.8 to 1.2 per cent; P., 0.3 per cent; S., 0.05 per cent; Mn., 0.6 per cent; Graph. C., 1.4 per cent; Comb. C., 1.0 to 1.2 per cent. Its tensile strength is about 33,000 lbs. (28,000 to 37,000) and its elongation is generally from 5-10 to 6-10 of 1 per cent.

In making gun iron at the Niles Works, 1,800 lbs. of coke are first placed in the cupola, then 3,000 lbs. of pig (mixed as in above formula), then 250 lbs. of coke, then 3,000 lbs. of pig, then 250 lbs. of coke, and so on till the cupola is charged full. The molten metal is of course poured as hot as possible. On all patterns for gun iron, the shrinkage allowed at Niles is ⅛ of an inch per foot, although some of the larger pieces (base-rings and chassis rails) do not shrink quite ⅛ of an inch.

The size of the cupola furnace employed depends upon the amount of metal to be melted at a time, and upon the kind of fuel. Besides the charge of pig iron and scrap, a lime flux is often added. In melting pig iron in the cupola, it is stated a

loss of 4 to 8 per cent, chiefly in the metallic iron, is sustained. As fuel, anthracite, charcoal and coke are used, good strong coke, as free as possible from sulphur (i. e., with less than 0 6 per cent S.) being preferred. The ratio of coke to iron is about 1 to 6.

At the Columbus Machine Co.'s works, Columbus, O., the following cupola mixture has given very satisfactory results:

Muirkirk charcoal iron	15 per cent
Salisbury charcoal iron	25 "
Embreville coke iron (high in C.)	20 "
Gun iron scrap	30 "
Steel (bloom ends)	10 "
Total	100 per cent

The gun iron obtained has the following composition: Si., 1.53 per cent; S., 0.05 per cent; P., 0.29 per cent; Mn , 0.45 per cent; Comb. C . 0 42 per cent; Graph., C., 3.01 per cent; Iron, 93.98 per cent Total, 99.74 per cent. (Analysis made by S. S. Knight.)

Its tensile strength averages over 30,000 lbs. and its elongation 0 4 per cent An exceedingly strong gun iron, made by Gen'l Rodman from selected charcoal pig and tested by the Ordnance Department, had the following composition: Si., 1.34 per cent; S., .003 per cent; P., .08 per cent; Mn , 1.00 per cent; Comb. C., .93 per cent; Graph. C., 2.19 per cent. It was tough, solid, with a fine granular fracture and a hard surface, but machined easily and finished finely. Its elasticity was comparatively large, due to its lowness in phosphorus and sulphur.

3. Semi-steel of excellent quality is now being made by the Rarig Engineering Co., Columbus, O., and used in castings for the 12-inch breech-loading mortar carriages manufactured by this concern. The name "semi-steel" was used as far back as 1873, according to Malcolm McDowell, to designate a cupola-melted metal resulting from charging scrap steel in the cupola with pig iron It was at that time made by Mr. Sleeth, of Pittsburg, Pa , and cast into chilled or dry-sand rolls and pinions of superior quality. Long before 1873 however, wrought iron or steel scrap had been used in making special grades of cast iron, such as tough cast iron for drop-hammer dies and for similar castings. Certainly the use of steel scrap or of similar material in a cupola or in a ladle is not a modern or patentable idea. Maj. McDowell in this connection deserves credit for calling attention to the need of chemical knowledge in good foundry practice and for making good semi-steel castings in a more or less systematic way. There is no fad or physic necessary, although a "secret "dope is sometimes used by so-called inventors, chiefly in order to throw a veil of mystery over a quite simple process. An analysis of one of these expensive "medicines," which, however, possibly serves a useful purpose by agitating or mixing the metal in the ladle and perhaps reducing its sulphur contents, is given below.

The phenomenal tensile strength (49,000 lbs. and above) claimed for certain gun iron and semi-steel castings is also misleading, if the size and treatment of the attached test coupons is not stated, as we shall see later. Tests have been and are frequently reported as correct, i. e., as fairly representing the pieces the physical qualities of which they are intended to determine when in reality they are from 3,000 to 10,000 lbs. per square inch too high. This is due to the fact that the coupons cast-on are only 1 to 1½ inches round instead of 3 inches, on castings 3 inches in section, and therefore chill and harden more rapidly and show a correspondingly higher strength than the castings. The depth to which the "chill" penetrates, as determined by special chill-blocks 6 x 4 x 1½ inches in size, cast in special molds in the same heat as the pieces, is a good indication of the tensile strength of the semi-steel cast, and serves the foundryman as a simple and convenient guide for grading his "metal."

At the Rarig Engineering Co.'s works, near Columbus, O., semi-steel is made in an 84-inch cupola with good West Virginia coke from the following charge:

Lawrence pig (No. 2)	59.3 to 69 per cent
Homogeneous steel (boiler plate scrap)	39.6 to 30 "
Ferro-manganese, 12 to 15 lbs. per ton	.6 to 0.8 "
Alloy in ladle, 8 to 10 lbs. per ton	.4 to 0.5 "
Total	100 per cent

In charging, the scrap steel is placed on the leveled-up coke between layers of the pig, so as to secure regularity in the working of the cupola. The resulting semi-steel has about the following composition: Si., .98 per cent; S., .06 per cent; P., .43 per cent; Mn.. .43 per cent; Comb. C., .75 per cent; Graph. C., .96 per cent. (*S. S. Knight.*)

The particular casting (base-ring) exactly corresponding to the above formula had three coupons of standard size (3½ inches square and 8 inches long) cast on, which tested as follows: No. 1, 33,680 lbs. tensile strength per square inch; No. 2, 35,730 lbs., and No. 3, 34,710 lbs. tensile strength per square inch.

A standard specimen cut from the elongation cylinder poured from the same heat as the base-ring showed .4 per cent elongation under a stress of 25,000 lbs., and broke under a stress of 34,790 lbs. per square inch. The above casting, like most of those made of semi-steel at the Rarig Works, was found to be free from blow holes and other defects, and was therefore accepted as satisfactory, both on inspection and on heat test. Such heavy pieces are frequently cast in loam or skin-dried green sand molds, properly anchored down and fastened, the metal being poured from two ladles at opposite sides at the same time. The preparation and drying of each mold takes from five to nine days, and the cooling of the casting two to four days, so that, with two pits for each, two mortar carriage base-rings and one racer can be obtained per week.

The alloy or "dope" put in the ladle is composed of the following elements: Al., 2.00 per cent; Mn., 8.71 per cent; Si., 0.22 per cent; P., 0.09 per cent; Fe., 89.06 per cent. Total, 100.08 per cent. (*S. S. Knight.*) It is obtained in granulated form at the fabulous price of $500 per ton. The actual cost of rough (unmachined) semi-steel castings, including molding, lies between $20 and $40 per ton.

Coming now to the matter of inspection, particular attention will be called to some of the influences which modify the strength of test coupons and thus lead to erroneous conceptions of the properties of the castings to which they are attached. The relative size and shape of the coupon, its position on the casting, the method used in turning it down to size, and the method of separating it from the casting to which it is joined, all influence the tensile strength of the coupon or test specimen to a greater or less degree. Let us then briefly consider the influences which these important factors exert.

1. Test specimens cut from coupons cast 1½ inches in diameter generally show an average tensile strength of from 1,000 to 6,000 lbs. higher than the same sized test specimens cut from coupons cast 3½ inches in diameter or square. The small coupons are frequently denser and harder than those of the standard size, because they chill or cool off more rapidly; they therefore show a higher tensile strength, and do not fairly represent the pieces the physical qualities of which they are intended to determine, unless they are of the same thickness. The stems of test specimens of gun iron should always be joined to their heads by gently curved fillets.

2. Coupons so placed that they can chill more rapidly than the balance of the casting, as stated, will give higher results than the average. Exposed coupons should therefore as a rule be rejected, as well as test specimens taken from the outside layer of coupons, and consequently containing their sand scaled skin or chilled surfaces. Satisfactory coupons must not have any nicks and should be placed tangential and not radial to the surface of the casting.

The temperature at which a cast of pig iron is poured and the length of time it has to cool are both factors which strongly affect the nature of the fracture and consequently the tensile strength of the castings produced. The cylinders for determining elongation should never be shaken out earlier than the castings of equal weight and section they represent, but should remain in the sand the same length of time. Mortar carriage base-rings, weighing seven tons each, and racers, weighing 14 tons, after casting take from two to four days to cool. The tensile strength of test specimens, taken from castings (such as elongation cylinders) which have been cooled uniformly, is not appreciably affected by the length of their stems. The Lorain Foundry Co. secure almost uniformly lower tests from their 8-inch chassis rails than from any other gun iron castings, the difference in tensile strength between such rails and base-rings poured from the same heat,

amounting to as much as 3,000 lbs. The higher tests are obtained, they claim, from coupons so located as to be subject to greater pressure in casting, although the higher tensile strength may possibly be referred to other causes.

3. The influence of vibration or the method of turning up elongation pieces is frequently shown by a lower tensile strength, when such pieces (they are 20 inches long) are rough turned with a too heavy cut and consequently jarred and sprung, as compared with specimens cut from the same elongation cylinder and handled more gently and carefully. Differences of from 500 to 2,000 lbs. may be due to this cause alone.

4. Coupons are sometimes taken off the castings by being hammered with a sledge. Such coupons are almost invariably weaker than they would be if separated from the casting by careful wedging. Too much stress cannot be laid upon this point, as it is frequently the cause of failures in test specimens cut from such shattered or weakened coupons.

In conclusion, the writer recommends the general adoption, in the iron trade, of the above described methods of testing, and the more extended and intelligent use than at present, of gun iron and semi-steel in the manufacturing world.

THE TIN PLATE MARKET.

The all-absorbing topic in the tin plate trade for the past month has been the tin plate consolidation, which has been practically consummated. At the request of the organizers the mills are making no sales for any deliveries beyond Jan. 1, and the result is that there is very little doing in the tin plate market, except for quick delivery. Prices have advanced materially and 100-lb. plates are now held at $2.70 to $2.80, f. o. b. maker's mill, December shipment, with no offerings beyond Jan. 1, except from dealers and others holding contracts on plates purchased some time ago.

The fact that substantially all of the mills are going into the consolidation indicates that the trust will have little difficulty in fixing prices and advancing the market; but owing to the large sales that have already been made to dealers and others, extending over the first half of the year, it is improbable that the price will be advanced beyond $2.85 or $2 90 for 100-lb. plates, Pittsburg district. The consumers and buyers of tin plate were slow to believe that the consolidation would be consummated and many of them now realize that it is a fact and that they have not covered their purchases for next year.

Pittsburg Foundrymen's Association.

The Pittsburg Foundrymen's Association held a well attended meeting in its new quarters, Frohsinn Building, Pittsburg, on Monday night, Nov. 28. A letter from John A. Penton, secretary of the American Foundrymen's Association, was read, accepting, on behalf of the executive committee, the invitation to hold the next annual convention in Pittsburg. The time will be fixed within the next few weeks. The matter of arranging for the suitable entertainment of the convention, which is expected to be the largest in the history of the organization, was put in the hands of the local executive committee, with full power to act and appoint sub-committees. In order to increase the membership of the Pittsburg association as much as possible before the convention, it was decided to suspend the initiation fee until the convention is held, members being received on payment of the regular dues. The paper of Mr. Thos. D. West on "Essentials in Obtaining Comparative Tests of Cast Iron" was read. This was published in these columns in advance, by request. A discussion followed.

THE crusade against smoke in Pittsburg is being vigorously prosecuted at present. Since the passage of the smoke ordinance a decided abatement of the nuisance has been observed, but several hundred proprietors of smoking chimneys have wholly disregarded the law. To these a letter has been sent within the past few days by smoke inspector J. J. Brennan, promising legal proceedings. A number have replied to the letter stating that they are preparing to do something, and these will be left alone for awhile. The smoke inspector is satisfied that by the employment of competent firemen 80 per cent of the smoke could be done away with. This is unquestionably true in all cases where the fuel burning devices are not constructed on a radically wrong basis, and the apparatus is not forced beyond its capacity.

LAKE SUPERIOR IRON MINES.

The Dunn Mining Co., operating the Newport mine at Ironwood, Mich., and the Palms mine at Bessemer, posted notices last week of a 10 per cent increase in the pay of its employes, to go into effect on Dec. 1.

Shipments from the Republic mine have closed, with a total of 135,000 tons, an increase of 10,000 tons over 1897. The 1899 output is expected to show further increase, the new shaft being utilized and some increase being expected from the new find.

At Milwaukee, Nov. 26, the Superior Court, in the case of Joseph Hyman against the Florence Iron River Co. ordered that the property of the company, valued at $421,000, be sold at public auction before Jan. 1. The mines of the company are situated about Florence, Wis., and Stambaugh, Mich. The property has been in the hands of S. T. Beatty, as receiver, for three years. The liabilities greatly exceed the assets. Ladenburg, Thalmann & Co., of New York, are the heaviest creditors.

There is a constant call for men from the copper regions of Michigan. Some of the employes of the open pit properties on the Mesabi are responding; others will find employment in connection with the improvement work on Minnesota ore roads, for which considerable expenditures will be made the coming winter.

The Roberts Iron Co. expects to open its mine in township 58-16 on the Mesabi range in a few weeks and ship considerable ore next year, which will be stockpiled this winter. It has been idle for more than a year. A sale of 20,000 tons of Roberts ore was made a short time ago.

The Minnesota Iron Co. is doing exploratory work at Soudan and Tower on an unusual scale, five diamond drills being steadily at work. The winter force will be larger than that of last year.

The employes of the Oliver Iron Mining Co. on the Gogebic range—Norrie and Tilden mines—were notified last week of a 10 per cent advance in wages. The hoisting of ore has begun at the Curry shaft of the Norrie. Additional miners are being called for.

The Brotherton mine at Wakefield has been having a large amount of water to pump the past season, due to the stoppage of its near neighbor, the Sunday Lake. It costs 18 cents per ton of the ore hoisted to pay the water charges. Add to this a royalty, and consider the smallness of the ore deposits and it will be seen that the company is kept busy securing a new dollar for an old one. The company expects to be active during the winter and looks to a division of its pumping charge by a resumption of mining operations at the Sunday Lake. The latter property has consolidated with the Iron Chief and will soon be busy again.—[Iron Ore.

The Oliver Iron Mining Co. has platted a strip of ground lying between the Zenith and Savoy mines at Ely, Minn., into 100-foot lots, which are being leased to employes of the company at a nominal rental, on condition that they will build houses on them. As a still further inducement to the men to build homes the company furnishes them with lumber and all other building material at wholesale cost on long time. A number of houses are already in process of construction and a number of additional lots have been leased.

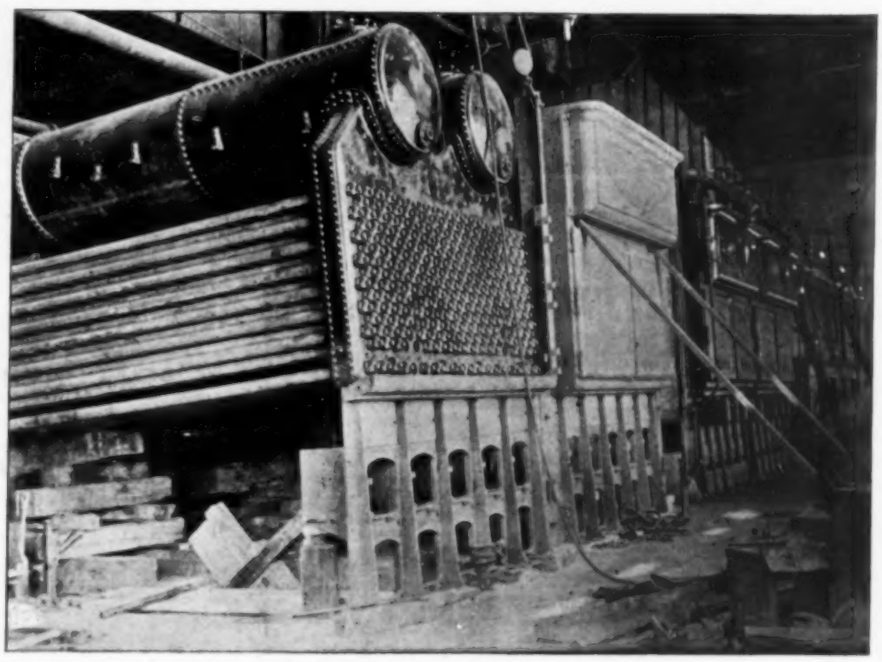
For the Cundy mine at Quinnesec, Mich., a new hoist and additional boilers have been ordered. The hoisting equipment will be furnished by the Webster, Camp & Lane Machine Co., of Akron, O. When the new machinery is installed, 100 additional men will be needed.

The improvements to be made the coming winter by the Duluth & Iron Range Road will cost in the neighborhood of $600,000. These will include the entire rebuilding of dock No. 1, making it 45 feet high and enlarging the pockets. The present structure will have to be taken down to the water, and the substructure completely overhauled and rebuilt. This dock work alone will cost probably $300,000. On the Stewart River branch about five miles were not finished last winter; this work will be carried on this winter.

THE Bethlehem Iron Co. furnished the engine forgings and all the shafting for the torpedo boat Davis recently built by the Wolf & Zwicker Iron Works, Portland, Ore. On her trial trip the Davis made an average speed of 23½ knots, or one knot more than contract speed.

THE HEINE BOILER.

The illustration gives a view of the boiler room of the Toledo Traction Co., Toledo, O., showing two 600-h. p. Heine boilers in course of erection, a previous installation having included four of the same size. In view of the fact that no side openings are required it is possible to place a large amount of power, with this type, in small space. The Heine boiler has been before the trade for about 14 years and has made for itself a creditable record. It was originally a German patent, developed by Henry Heine, a well known mechanical and civil engineer. Mr. Heine submitted the design to Col. E. D. Meier, of St. Louis, present president of the Heine Safety Boiler Co., the latter having been a college mate and later associated with Mr. Heine in railroad work. The result was the conclusion of arrangements for the introduction of the Heine boiler in the United States, and the formation of the Heine Safety Boiler Co. Improvements were made upon the original design, the result being the Heine boiler as now known to steam users. It is constructed upon lines suggesting that the prime object in a boiler is to obtain the highest efficiency. This is only possible by a thorough and unimpeded circulation and by carrying the casings in such a manner that the greatest amount of heat may be absorbed by the boiler; and further by having the boiler freely accessible to the operator, so that he may not only thoroughly inspect it while in operation, but that it may be cleaned and repaired easily. Circulation is provided for, in this boiler, by ample throat areas through which the water travels in its circulation; and the arrangement of the tile upon the tubes insures a maximum economic result from the fuel.



THE HEINE BOILER.

Accessibility is secured by resting the boiler upon the two ends, which are exposed, excepting the ornamental casings, which may be easily opened. Thus the operator has not only absolute facilities for removing the soot from the tubes but also for noting their appearance while the boiler is in operation. This may be done, too, without physical discomfort.

It is an axiom in boiler practice that the boiler that may be taken care of easiest will, on general principles, be taken care of the best; and as the efficiency of the boiler, to a certain extent depends upon its care, the boiler affording the best facilities in this direction offers an extra guarantee of economical success.

The Heine boiler is made entirely of boiler plate and is built in accordance with the standards of the American Boiler Manufacturers' Association. In addition, every plate is subjected to a special test by a firm of testing engineers.

CONSOLIDATED TIN PLATE CO.

The company formed to take over the bulk of the tin plate plants of the country will be known as the Consolidated Tin Plate Co. The charter is to be taken out in New Jersey this week. The capital stock will be $50,000,000—$20,000,000 preferred and $30,000,000 common. Of each, $2,000,000 will remain in the treasury. Each share of preferred carries a share of common, making $18,000,000 of each to be issued, and leaving $10,000,000 of common, which goes to the promoters. The preferred is a 7 per cent cumulative stock. The stock is being skilfully manipulated, and it is claimed hs sold for 120, for the preferred, carrying the common with it. It is also claimed the common is now being sold separately, consolidation rights bringing as high as $30 a share, both stocks being of $100 par value. D. G. Reid will be president, with headquarters in Chicago, where the general offices will be. W. T. Graham will be first vice-president, with headquarters at Pittsburg, where a branch office will be located. He will retain the presidency of the Ætna-Standard Iron & Steel Co., of Brdgeport, O.

It can now be stated positively that the following concerns have not sold their plants to the promoters: Canonsburg Iron & Steel Co., Pittsburg; Neshannock Sheet & Tin Plate Co., New Castle, Pa.; Whitaker Iron Co., Wheeling, W. Va., and St. Louis Stamping Co., St. Louis, Mo. It is possible that several others may be out. There are a number of reports concerning the building of new plants intended to fight the combination. The plants which are now built but not in the deal, will furnish competition. One of these is excellently located and equipped, now having five hot mills, with three additional mills in course of erection.

THE thorough ventilation of the Boston Subway, as well as the prevention of any possible moisture, is receiving careful attention. A thorough circulation of air is necessary and is to be secured by the operation of four special electric fans recently constructed and installed by the B. F. Sturtevant Co., of Boston. These are of the cone type, two of them seven feet in diameter and two eight feet in diameter. Each is driven by a special Sturtevant direct-connected motor, and operating together they have a capacity equivalent to changing the air in that portion of the subway with which they connect, once in fifteen minutes.

STEEL plants and wire and nail mills having business with Japan have been hurrying shipments forward lately, in view of the advanced tariff, which goes into effect Jan. 1.

Review of the Technical Press.

BY DR. RICHARD MOLDENKE.

The Development of Stress Figures on the Surfaces of Strained Bodies. [*Baumaterialienkunde*, 6.]—The entire issue of this journal is taken up by an article on the above subject by Prof. Alexander Rejtoe, being the German translation of the Hungarian original. The peculiar figuring of a piece of polished metal when subjected to stresses had been observed as far back as 1854. It remained, however, for a committee of French artillerists, who were examining the strength of various bodies, to discover definite laws on the inter-relation of the network of lines thus seen. L. Hartmann published these results simultaneously with a similar line of experiments brought out by Prof. Rejtoe. The interesting theories evolved by the latter, reviewed in these columns recently, are admirably substantiated by the practical results found by the French commission. The principles of force transmission and internal friction have thus been demonstrated experimentally to exist not only after the elastic limit has been passed, but long before. The method employed by the French commission to bring out the stress figures was as follows: Below the elastic limit the polished surfaces of the test bar were treated with dilute acids. Where heavy deformation was wanted this treatment was omitted. Steel bars were also colored by heating up to nearly 400 degrees F., and after stretching were carefully rubbed with fine emery paper to bring out the network of lines. Not only were gradually increasing loads employed, but also shocks. Under all stresses with uniformly distributed loads a regular system of line was the result, the character of which depended upon the shape of the specimen and the nature of the load. The tensile test gave the following characteristic results: A thin strip of sheet metal developed two systems of parrallel lines crossing each other, one leaning toward the right, the other toward the left, the angle with the direction of the strain in each case being over 45 degrees. On prismatic bodies a similar series of lines originate on the sides. The surfaces of cylindrical bodies are marked with two sets of spirals running in opposite directions. The compression test gave regular systems of markings only when the height of the specimen was nearly equal to the thickness. A cube when compressed exhibited systems of lines on the free sides, some of them running down sideways to the right, then stopping suddenly at another set of lines running down sideways to the right. On the cylinder the same sets of spirals appeared as with the tensile test. A sphere, which had been truncated by two parallel cuts, when compressed showed two sets of spherical spirals crossing each other in going right and left. Hollow cylinders also show these crossing spirals. In making a study of this peculiar phenomenon it would seem reasonable to attribute the markings to forces acting along the surfaces or tangential to them. Prof. Rejtoe shows that after establishing the direction of the stress acting on the individualmolecules this may be considered a resultant of two other forces, one acting along the surface, and the other normal to it. He further shows the action of these components, taken in connection with the laws of transmitted forces, to be along those molecules which lie in the places where the lines appear. Here the outward component finds little resistance on the part of the surrounding unaffected masses, and the metal stands out in ridges arranged in characteristic groupings.

The second section of the article describes the effect of partial loading, the experiments being made by pressing a small cylinder upon one of larger diameter, or upon a cube, and by crossing long prisms and compressing them. The surface of a cylindrical body thus treated showed systems of doubly curved lines crossing each other; the free portion of the upper surface had logarithmic line systems. In the case of a cube pressed upon by a small cylinder similar systems of doubly curved lines were observed along the middle portion of the sides, while the upper free space had a line system corresponding to a Maltese cross. When prisms were crossed and compressed three entirely distinct sets of lines will result. It also seems that in this method of testing the markings appear in three separate intervals of time. The third section of the article takes up the testing of pipe by internal or external over-pressure. For the former tests conical pins were driven in, resulting in a series of spiral markings on the exterior of the pipe. For external compression the pipe in question was inserted in another larger one and this pulled. The compression of the inner pipe thus obtained resulted in a system of spirals on its inner surface. Shearing materials showed markings on the sides of plates corresponding to those obtained with a tensile test. The bending test is especially interesting, as the external evidence of the forces acting upon the bars appeared gradually and in a systematic manner. A semicircular set of lines on the sides was the result of using a wedge-shaped compression piece at the middle, while lines of double curvature extended downward to both supports where they cut other lines of double curvature extending directly upward. When supports and pressure pieces with a rectangular area were used, and when the bars were supported unsystematically, things were complicated very much; nevertheless well defined systems of lines give evidence of the nature of the forces in action at the surface. The dishing out of sheets comes next and exhibits a series of lines radiating outward and crossing each other just as the exquisite markings on the shell of a defunct echinus thrown up by the ocean waves. Finally come the following conclusions of Hartmann, as reviewed by Prof. Rejtoe: All stresses applied to bodies give rise to systems of lines on their surface, the direction of which form given angles with the line of stress. The externally applied stress acts upon those particles which form a given angle with its line of application The number of lines grows with the stress applied, but the angles remain unchanged. The systems of lines are produced both below and above the elastic limit. The harder the material the cleaner the markings. The characteristic angles are noticeable in the cracks and fractures. The higher the temperature the less distinct the lines will be. Every deformation increases the elastic limit, which is therefore not a property in a metal of an absolutely fixed value.

Grant Machine Tool Works.

The Grant Machine Tool Works, of Cleveland, organized in August of this year, are well equipped for the manufacture of the leins of machine tools they are to put upon the market, and promise to become a noteworthy addition to the machinery building trade of the Central West. J. J. Grant, long prominent as the mechanical expert of the Cleveland Machine Screw Co., and previously with Pratt & Whitney, is the head of the new concern. The tools it is bringing out are after Mr. Grant's designs, developed as the result of his long experience in the production of machinery and his study of the most approved equipment. The company will manufacture milling machines, lathes, drills, boring mills, and special bearings of all descriptions particularly for large balls. All will be built on most modern lines and new features are embodied calculated to secure added efficiency. The semi-radial drill, for example, presents quite an innovation. It is designed particularly for heavy castings, and built with a view of handling the work quickly. It is unlike anything now in use, being the result of special study in this class of machinery and the needs of users both in the United States and in England and Continental countries. Both hand and engine lathes will be built. Labor saving features have been incorporated in these machines and accuracy has been a special aim. They are built with a view to doing the heaviest work. All bearings are made very strong, as is also the gearing, the study being to produce machines that will take heavy cuts and do rapid work The ring lathes are designed for accurate work on cylinders and packing rings. These machines have been approved for railway work, and an excellent demand has developed for them in the foreign trade.

The new company occupies jointly with the Grant Ball Co. the plant at 66–72 Clarkwood ave., Cleveland, and is well equipped for its work. Estimates can now be given on any of the tools named above, and within the next few weeks complete catalogue descriptions will be issued.

A REPORT published in a South Chicago paper to the effect that Iroquois Furnace had been sold to the Illinois Steel Co., to be operated in connection with that company's South Works, is denied by Charles F. Forster, general manager of the Iroquois Furnace Co. Mr. Forster says no such sale has been made nor is it contemplated.

EVOLUTION OF ENGINEERING.*

BY C. W. HUNT.

Let us first consider what we mean by the word engineer, not what it meant historically, but what it has come to mean in the active world of to-day, and try to bring our individual conceptions into harmony each with the other. Following Tredgold, I have herein used the word engineer in the broad sense of one who is skilled in the application of the materials and forces of nature to the uses of man. Considered in this broad sense, the engineer is interested in every investigation and discovery in the whole realm of nature. Experience has shown that every field is tributary to his work. The theoretical abstraction of yesterday becomes a demonstration to-day, and to-morrow it is the task of the engineer to apply it to the uses of man. The new discoveries of materials, forces and laws which now succeed each other so rapidly, make a corresponding increase of the responsibility and changes in the practice of engineering.

That we live in a world of changes is at once our opportunity and our pleasure. Some of these burst upon us and attract universal notice, while others come so slowly that they are almost unobserved. A change of the latter character has been taking place of late years in the work required of professional engineers. This has largely come from the development of our manufacturing institutions from the position of being a minor factor in our economic life, to being one of great importance, not only in numbers, but in individual magnitude, and the necessary employment of skilled engineers to conduct their technical affairs.

The engineer of the user and the engineer of the maker have widely different duties. Consider how different may be the information required in practice by two classmates, whom we will designate as "A" and "B," who graduate from college as engineers. "A" secures a position in the engineering department of a city, and commences his work, which may be the designing of a new water pumping station. His college course has fitted him for the work. His text books were suited to problems of this character. He finds abundant information on all branches of the subject in data published in the proceedings of scientific societies, in technical literature, and in annual reports of city departments. The forms of contracts to be entered into are at hand, all found elaborately drawn, with every point safe-guarded, and need only a little selection and adaptation to suit his case. They place in his hands the power to decide absolutely and without appeal all questions which may arise in carrying out the work.

"B" obtains employment in the engineering department of a manufacturing corporation, which in due time estimates and submits tenders for the pumping plant for which "A" has issued specifications. He will find that the form of contract proposed by "A" has many minute and carefully worded clauses to bind and limit the supplier. The tender to be submitted for the work must in its scope and wording protect the interests which "B" represents not only in a genral sense, but in every one of the clauses of the proposed contract. Every obscure phrase and every adjective used by "A" must have definite consideration and be clearly defined in both an engineering and a legal sense. "B" here finds that the information derived from his college course is largely inapplicable, and there is no technical literature which he can use, either as a general guide for making a form of tender or the proper expressions to use to define or limit the obscure clauses of words found in the specification.

Looking at the subject from a purely technical point of view, we see quite as great a variation in their work. "A" would require only a general knowledge, while "B" would require the most thorough and exhaustive information of the qualities of constructive materials, and shop practice available in that particular location. The farther we carry the comparison of their work, the more clearly it is seen that the educational requirements are becoming more complex to correspond with the growing specialization of engineering work.

American and Foreign Engineering Practice.

There is another phase in engineering practice represented by the duties of "A" and "B" which now becomes interesting if the work of American engineers is to take the place in the world at large to which the indications now so plainly point. In other countries it is a common practice for "A" to make all the general designs and all of the details, and the supplier has no responsibility either for the design or for the efficient working of the plant when completed. If errors or omissions are found in the drawings or specifications, the cost of the changes required are paid by the purchaser, in the usual bill for extra work In this case the duties of "B" are small or disappear altogether.

The American practice is tending to the method of making the requirements issued by "A" of a general character which will cover the results sought, and leave to the supplier, "B," the work of designing the particular means to accomplish the desired end. Business has become of such a magnitude, and so complex that one mind cannot fully grasp, and readily handle, the new discoveries, new materials and new practices, which now come so rapidly. For efficient and economical results, each phase must be handled by an expert. There will be many "B" engineers to respond to the requirements of "A," and each will present for consideration different ideas, different materials, and different shop practices. "A" must select from these various plans and details submitted, the one which best promises to fulfill the requirements. It is a division of labor between "A" and "B," each of whom, by tastes and training, is especially fitted for his part of the work. We may paraphrase their duties by saying that "A" is a judge, "B" is a counsellor.

At the present time we cannot expect our technical schools, painstaking and perfect as they are, to prepare both "A" and "B" fully for such new and varied duties, or even to have their instruction in the practice of engineering fully abreast with the latest practice, or at least not until progress in the arts and sciences has substantially ceased. It takes time for a new practice or a new result to be recorded, published, considered, and adopted by the teaching staff. This difference between the teaching and the engineering practice of the day is not only an indication of progress in engineering, but in some measure an index of its rate. The student then must expect, as a normal proceeding, to supplement his graduating acquirements by further study, together with association with his professional brethren, in order to place himself abreast of the times, and to be fitted for the most effective and useful service.

Engineering theory and practice are rapidly extending with the general advancement of our economic interests, and the engineer, whether he be a young graduate or otherwise, who does not make use of the modern aids to information, among which are to be counted scientific societies and literature, and a personal association with his brethren, with the innumerable hints and suggestions which come from these, will soon be found struggling with what seems to him adverse fate, but what, in reality, is inferior knowledge, behindhand knowledge; or, plainly speaking, ignorance greater or less. The engineering world has passed by him, and he must then view the working out of the law of the survival of the fittest, with what grace he may.

Laboratory Development

An interesting development in the engineering of the present day is the rapid growth of the experimental equipment of our colleges and technical schools. There seems to be no limit to the expense and the completeness of the illustrative and experimental machinery which is being installed for the instruction of the students of these institutions. And not less valuable is the learning, industry, and skill of the professors in charge of, and directing these schools, whose theoretical acquirements are supplemented by being in constant personal touch with the industrial interests of the country.

It is possible that by an organized effort the magnificent equipment of trained professors and experimental apparatus could be brought in closer touch with each other, that their work and investigations may, to a material extent, be made to proceed on a predetermined plan, with instruments standardized in the same manner. This would broaden their field of experimental investigations, lessen the duplication of work, systemize the publication of results, and more rapidly extend our knowledge of accurate engineering data. I will not now discuss the suitability of the present time for presenting the various interests, the idea of a conference with an

* From the President's Address, New York meeting, American Society of Mechanical Engineers, Nov. 29-Dec. 2, 1898.

invitation to discuss the points whereon they might harmonize and systemize their investigations, instead of following the present independent and desultory ways. Frequently it only needs that an organizing effort be made to find the field ripe for the harvest.

Work of Scientific Soiceties.

Every age has produced most ingenious and able engineers and mechanicians, as is conclusively shown by specimens of their work. Many of these have been preserved and handed down to us, causing us to wonder at their skill when we consider the limitation of materials then available, and the paucity of exact knowledge of the laws of nature in their time. But the special knowledge and experience of those masters in the art, practically disappeared when death claimed the originators, as only a small portion usually remained in the minds of the pupils, and but little of this was transmitted to posterity. It was only when scientific and technical societies for the preservation of accurate records had developed, in the fullness of time, making all the world pupils, that the valuable knowledge so laboriously obtained was preserved and handed down to those who, sooner or later, could utilize it for the comfort and the elevation of mankind.

These lately developed scientific societies, which are so prominent a feature of the present day, were organized for the discovery and the universal diffusion of scientific knowledge, an object entirely different from that of all mediæval guilds and trade organizations. At first they were largely philosophical, discussing theories and experiments which at the time appeared to the community at large to have little or no direct bearing on the practical affairs of life. The members presented to the society the results of their investigations and experiments, in the form of written papers, making them permanent records to be consulted and made available by others who were contemporaneous, or who would succeed them. This was the vital germ which was to develop and elevate science and its application in industrial work in succeeding ages. As industrial interests became more important other societies sprang up, each devoted to some particular phase of scientific or technical work, each gathering, selecting and recording data, not alone for their members, but to become permanent additions to the general fund of scientific and engineering knowledge. The growth of the societies has been accompanied by a gradual decrease of secret methods of manufacture, formerly so prominent, but which have now practically disappeared in our industries. Manufacturing supremacy is now decided by other factors.

The advance made in the accumulation of useful data and more accurate knowledge in practical engineering gained one season, is presented to a scientific society the next, and still later it will be embodied in text books for the instruction of students who are soon to take our places and carry on our work. Until attention is called to the subject, less we are not likely to realize that in their essential parts the great bulk of the engineering data available to us now have been first presented to a scientific society, and there permanenlty preserved until the time came for their utilization or application. It is from this great fund of information, principally accumulated during the last century, that we draw upon for the materials for our text books, our general treatises, and our engineering handbooks.

Scientific associations aim to add to the great fund of information available to every engineer the world over, and not for the benefit of a limited clientage. The greater the availability and the publicity given to the published proceedings of a scientific society, the more nearly has the society accomplished the chief object of its existence.

The engineering and scientific work of to-day uses one or the other of two systems of metrology,—the English or the metric. The discussions of the relative importance and the desirability of these systems of weights and measures are frequently interesting, and may to some extent be useful in familiarizing the terms and making easier the conversion of quantities from one system to the other. Practical engineers can, however, lay aside academic discussions on the advantages or disadvantages of either, and recognize that the two great systems of metrology are each used by great engineering nations to the practical exclusion of any other, and they may safely assume, without discussion, that they are not likely in the near future to be changed in any material way by those using them.

It is especially desirable that English speaking societies shall give every practicable aid to engineers using the metric system of measures, that the work of their engineers may be readily available and with the least possible trouble in making conversions of quantities from the English to the metric system. Such computations are always troublesome to perform, and distracting to the mind when undivided attention is required by the subject matter of the article. If the numerical expression in English measures is followed in a parenthesis by the exact metric equivalent, the article is practically translated when printed, as most engineers using the metric system read the English language, although they may not speak it, or readily make numerical conversions.

Marvelous Industrial Progress.

It has long been evident that we are making rapid progress in perfecting our manufacturing machinery, as well as organizing and developing our industries, thus constantly increasing the efficiency of our labor, until we have lately reached a point where an hour's labor with its facilities produced more of our principal products, and transported them farther, than an hour's labor would do in any other part of the world.

The late war has revealed to us the fact that we have gone on reducing the cost of our products, and increasing our capacity for production, until our country alone does not furnish a sufficient market to insure steady work for our labor, and prosperity for our merchants and manufacturers. Like confined waters, the tendency of these economic forces has been to break out from their confinement and equalize trade conditions by seeking a market in the world outside. If articles which are necessary to supply the wants of man can actually be made with less labor and cheaper here than elsewhere, here they will surely be made, though it modify our traditional ideas of isolated position, and our protective theories. One hundred years ago the iron trade of Sweden was greater than that of England, and remembering the great changes which have taken place in the last hundred years, it would be rash to assume that the momentous economic changes which are now taking place, may not cause an equally great shifting of the centers of more than one phase of industrial activity.

Turning now to the effects of this accumulation of scientific literature available to all alike, and the results following its application by organized methods of procedure, our first glance will show prominently the wonderful and rapid increase of the importance of engineering in our industrial life. It has transformed almost every phase of it, and put into our hands materials and processes which make the actual life of our immediate ancestors seem primitive by comparison.

Commencing under adverse conditions and developing in a field of restricted capital, with scarce and high-priced labor, engineering in America has applied the forces and materials of nature to the uses of man in a characteristic way. Freedom from mediæval traditions and the hampering conditions found in the older countries, left them substantially free in the choice of means to accomplish their end. Influenced as our engineering has been by the experience and the work of other parts of the world, yet we cannot escape the fact that its development was essentially independent, and in some phases unique. Improvement has followed improvement in technical matters, profits and savings have been added to the capital invested in our industries until the continent, two hundred years ago an untraversed wilderness—one hundred years ago a struggling nation—struggling with industrial difficulties and serious political problems—has triumphed over these early limitations, and has developed into a nation which, in numbers, prosperity, and wealth takes a prominent position among the great nations of the world.

Whichever way we turn, we are met by a scene of marvelous changes, which have followed the advent of the engineer on the scene. A view of one subject will in a measure serve to represent these changes, and to recall similar illustrations to your minds which differ from this only in degree.

It is but a few years, well within the memory of men now living, that our navy and all the other navies of the world were composed of sailing ships. In one of these vessels a

mechanical germ was introduced in the form of a steam engine and an engineer. The grave question soon arose as to what should be the status of the new intrusion into the personnel of the ship, the engineer. This factor, which was soon to revolutionize the navy, was considered quite important at that time, as is shown by the first official record on this subject in the Navy Department at Washington, stating that it would seem that such persons should be exempt from the penalty of corporal punishment.

The engine grew in size with each succeeding vessel, and as it increased, the sails correspondingly shrank, until finally they disappeared altogether. New mechanical germs soon found a lodgment in other parts of the ship, which in a few years have so developed that hydraulic and pneumatic pressures are produced, and electric currents are generated and distributed, to govern the rudder, hoist the anchor, ventilate the compartments, energize the combustion, revolve the turrets, train and control the guns, handle the ammunition, and purge the ocean's water of its impurities, making it wholesome for the ship's use. Following these in quick succession came incandescent lamps and searchlights, breech loading and rapid-fire guns, multi-charge automatic guns, and mobile torpedoes, one mechanical appliance rapidly following another, until the sailing ship of the line, which but just now embodied the result of hundreds of years of thought and experiment, has been completely transformed, from keel to topmast, into a vast machine, controlled and operated even to the least important function, not by sailors, but by mechanicians.

In every phase of our industrial life the changes wrought by the engineer are quite as evident; for instance, note the changes in the manufacture of steel, development of electric locomotion, in iron construction in buildings, in machine tools, in agricultural implements, in sewing machines, in textile industries, and in electric metalurgy.

The Engineer's Life and Character.

The life of the engineer has a full measure of the labors, the trials, the discomforts, and the disappointments which are found in this, as in every other walk of life. But it also has the successes which come from well-directed labors. It is not, however, either the useful work or the successes of life which bring happiness. It is man's ideals which make him happy. Let us together survey some of the surrounding influences which tend to give high ideals of life to the engineer, no matter what the vexations of the moment may be. We will pass in review the interesting character of his daily work, his pure-minded associates, the fascinating scenes, and the higher pleasures of life by which he is surrounded. We will then better appreciate with what elevated emotions a father can lead a son, or a teacher his pupil, to the path of an engineering life, and place in his hands the mathematical, chemical, and physical implements to enter upon a work which will bring him both pleasure and honor.

Whichever way engineering may develop as time rolls on, its elevating influences are constantly at work on the mind and on the character. The work is carried on under unchangeable laws, which must be rigorously applied and adhered to, or failure is sure to result. Man builds to master, to resist, or to guide the forces of nature. If he has rightly judged the conditions, his work stands as a permanent monument of the fact; but if otherwise, the irresistible laws of nature will develop the defect and discover his ignorance, incompetence, or error to every observer.

Hence he laboriously seeks out the unseen laws and forces, then expresses the revelation in a workable form for his daily use. He tests his materials with painstaking refinement. He measures electric resistances with an accuracy now reaching the point of one in four millions, time to one three-millionth part of a unit, divides a circle with a mean error not exceeding the one-millionth of the circumference, makes surfaces six inches square with a variation from absolute flatness of less than one two hundred thousandth of an inch, rules lines which vary from absolutely perfect spacing by only one three-millionth part of an inch, sees clearly the spectrum of samarium when one part is diluted with three million parts of lime, and surveys lines 11 miles long in the open air with an average variation in three measurements of only four-tenths of an inch.

The effect of living and working in such a sphere of action, where it is inconceivable that an engineer could knowingly be otherwise than exact in his work, should tend to influence the whole trend of his life and character, and make them to a greater or less degree a reflex of his daily work. He of all men has the most unchangeable and exalted basis for his ethics—the clearest of all knowledge of the disastrous results which will surely follow the violation of law. The very qualities of his mind which make his work a pleasure and a success will all tend to bring his every act into compliance with the inexorable laws of the universe. If it is otherwise, and his conduct is not guided by the laws of right doing and right thinking, and his ethics not in accordance with them, then, and to that extent, he is not an engineer—not one who si skilled in the application of the forces of nature to the uses of man.

The Engineer's Broad Outlook.

It is with hesitation that I ask you to contemplate the pleasures of life enjoyed by those whose daily walk is thus surrounded. Words fail to describe the exquisite pleasures and the noble aims which are inspired by the contemplation of the wisdom and beneficence of the laws of the universe, which the diligence of man has revealed to us. Who can estimate the satisfaction which comes to the mind of the engineer from the knowledge that his work, the fruit of his investigations, and the wisdom of his decisions will be judged, not by fallible human methods and its caprices, but by the infallible and immutable laws of the universe.

Then consider the pleasure which comes from working in the open air, in the broadest light, where every interested one can see his difficulties, his investigations, his adaptations, and finally, if God has given him ability equal to the task, his solution of the problem. When victory comes, he is given the honor due to the work in unstinted measure, and he can accept it with propriety and count the commendation as one of the pleasures of life.

It is inspiring to the earnest engineer to feel that the actual workings of his mind and his inner and fundamental conception of the forces of nature, of resistances, of materials, of workmanship, will be shown in his works, as in a mirror. Roebling, Ericsson, Sir Benjamin Baker, and Edison have worked, as it were, in a glass house. Their thoughts and judgments are shown to all the world, not by inadequate words, but in the works of their hands—the Brooklyn suspension bridge, the turreted Monitor, the Forth Bridge, the quadruplex telegraph—the enclosed filament whose electric conductivity increases with the current. Then he has the gratification to the mind which is found in comprehending and intellectually seeing, as clearly as in a diagram, the theoretical lines of the forces in a structure, and then clothing those lines with materials of strength and resistance, to make them realities, and adapted to do the everyday work of life. The Brooklyn suspension bridge by Roebling shows an almost ideal correspondence of the two, so that it may represent either theory or practice, depending on which way at the moment we choose to look at it. Again, he uses a system of weights that cannot be seen or handled, the purely intellectual atomic weights—yet the rock under our feet is not more firm and real than is the work done with these intellectual aids.

Working in a field and in touch with a body of his fellow men having similar tastes, he sees on every hand scenes of engrossing interest—the telescope recording the position and motion of stars which no human eye has ever seen; the spectroscope analyzing the materials of the sun and stars with all the accuracy which it would show if the articles were in the laboratory; looking with Roentgen rays through a double-barrelled rifle and seeing not only the leaden bullets within the steel barrels, but also the wads and the charges; and photographing lines in the ultra-violet spectrum far beyond the reach of our vision. He stands by a quartz filament galvanometer which indicates an electric current so minute that if it should be increased in magnitude eight hundred thousand times it would still be only the one-millionth part of an ampere, and on the other hand sees the Niagara electric generator of five thousand horse-power, with a current so much larger than that of the galvanometer that the difference can only be expressed mathematically, not in colloquial language. He sees with entrancing interest the liquefaction of hydrogen by the physicist at a temperature of only twenty-three degrees centigrade above actual zero. He shares in the enthusiasm at the results of two years of unremitting work in

the photo spectrum in isolating a new element—monium, in the Hertz electro-magnetic waves now applied in wireless telegraphy; and in the newly discovered element in the salts of uranium, whose radiations make the air through which they pass a conductor of electricity. More nearly touching him personally comes the work of the biologist, whose quest for the thing we call life has continued from the primitive man to the present time. Constantly flitting from his grasp, it has seemingly passed from fire and storm to mountain and deep, from animal and plant to seed, to cell, and now it has been followed to the molecule or the atom, and yet it as completely eludes his grasp or even his comprehension as ever it has. But followed it certainly has been, by all the laws and forces of nature at the command of man, until the search for it is now in the molecule or the atom, a space physically so small that only the trained imagination can even faintly comprehend its minuteness.

And there, on the outskirts of this unexplored world, stands man, with spectroscope and polarized light, peering over the sphere of action, which we call an atom, well knowing that therein lie wonderful forces, activities, and at least the effects of that mysterious entity, life itself. He sees a field for investigation so fraught with possibilities, so infinitely beyond the comprehension of any conception of the capacities of the human mind, that he stands gazing into the abyss with the same devout wonder and awe as does the astronomer when viewing the illimitable heavens. The two are standing, as it were, back to back, and each is gazing into an infinity—one into the infinitely great, and the other into the infinitely small.

Thus stands the engineer in the midst of a countless number of earnest explorers in the field of unrevealed nature, and, so to speak, sees the tools forged and the materials discovered with which he is to work. Cheerfully can he enter upon his daily tasks with the consciousness that his application of these discoveries is of real service in lightening the burdens of life, as well as elevating and ennobling his fellow men.

The scenes that we have just brought to our intellectual vision are not those of the untrained imagination, of rhetoric, or of unreality, but those of the most rigorous truth, among the most real and matter-of-fact things known to us in all the realms of nature, and brought before you in the plainest language at my command.

We have traversed a wide field together, and now as we draw near to a personal parting, never to meet again under similar circumstances, let us, as we travel the way of life, appreciate its elevating pleasures, and carry to our daily tasks and to our homes a higher realization of the dignity of the life and the work of the engineer.

A COMPARISON has been made between the monster locomotive recently built at the Pittsburg Locomotive Works for the Union Railroad, Pittsburg, and those built for the Great Northern Railroad by the Brooks Locomotive Works. The Pittsburg engine has a weight of 208,000 pounds on driving wheels and 22,000 pounds on the truck or pony wheels, a total weight, including tender, of 334,000 pounds. The cylinders are 23 x 32. The Great Northern engines have 172,000 pounds on drivers, and have a total weight of 308,000 pounds inclusive of tender, and this shows a difference of 26,000 pounds in favor of the Pittsburg engine.

Lippincott's Magazine in its 32nd annual announcement, that for 1899, says that it will continue to pursue its well known course. One feature that has made it especially attractive is the complete novel, which appeals to the reader who objects to the story "to be continued in our next." Each number and each article is complete in itself. *Lippincott's* has aimed to be popular in its literature and to pay attention to the substance and style of contributions as well as to signatures, bringing forward writers whose work has merit, though their names may not be familiar. In the December number the complete novel is "Mrs. Russell's Sister," by Annie Eliza Brand, the scene being laid in London. "Philadelphia a Century Ago" is sketched by Kate Mason Rowland, through letters of Wm. Stoddert, first Secretary of the Navy. There are a number of creditable sketches and short stories.

BLAST FURNACE GAS FOR POWER.

The economy of employing in the steel works the waste gases from the Edgar Thomson blast furnaces not now effectively utilized, has been investigated, it is said, by the Carnegie Steel Co. This subject has had little attention in the United States, at least in so far as the employment of any portion of blast furnace gases in the direct production of power is concerned. The Blast Furnace Power Syndicate of London has just issued a pamphlet giving late details of the exploitation of the Thwaite patents for utilizing blast furnace gases. The Glasgow Iron & Steel Co., and the Cockerill Co., of Seraing, in Belgium, are the only two concerns that have actually put this system in practice, but elaborate arrangements are now being made for applying it at the works of the Barrow Hematite Steel Co. and the Seaton Carew Iron Co.s' furnaces at West Hartlepool. Plants are also being erected in Germany and in France. Meanwhile the Cockeril Co., in its recently published report of 1897–98, states that the system at Seraing has exceeded the most sanguine expectations.

Professor Hubert estimates that the production of a ton of pig iron in the blast furnace is accompanied with the production of about 4,300 cubic meters (about 151,000 cubic feet) of gas, or (at 100 tons per day) 18,000 cubic meters (634,000 cubic feet) per hour. Allowing one-half of this amount for the stoves (which, however, take a variable quantity), there would be left 9,000 cubic meters (317,000 cubic feet) for power purposes. Burned under steam boilers, the horse-power would vary from 300 to 1,000, according to circumstances. This amount of gas would, he thinks, be equivalent to 3,000 h. p. in a gas engine. But he found in actual practice that he obtained only 1,800 h. p., and that 400 h. p. was needed by the blowing engines, so that he had 1,400 h. p left for other purposes. It is a question whether, with the large gas engines now being constructed, it will not be possible to drive the blowing engines of a blast furnace plant with gas, and to dispense with steam engines altogether.

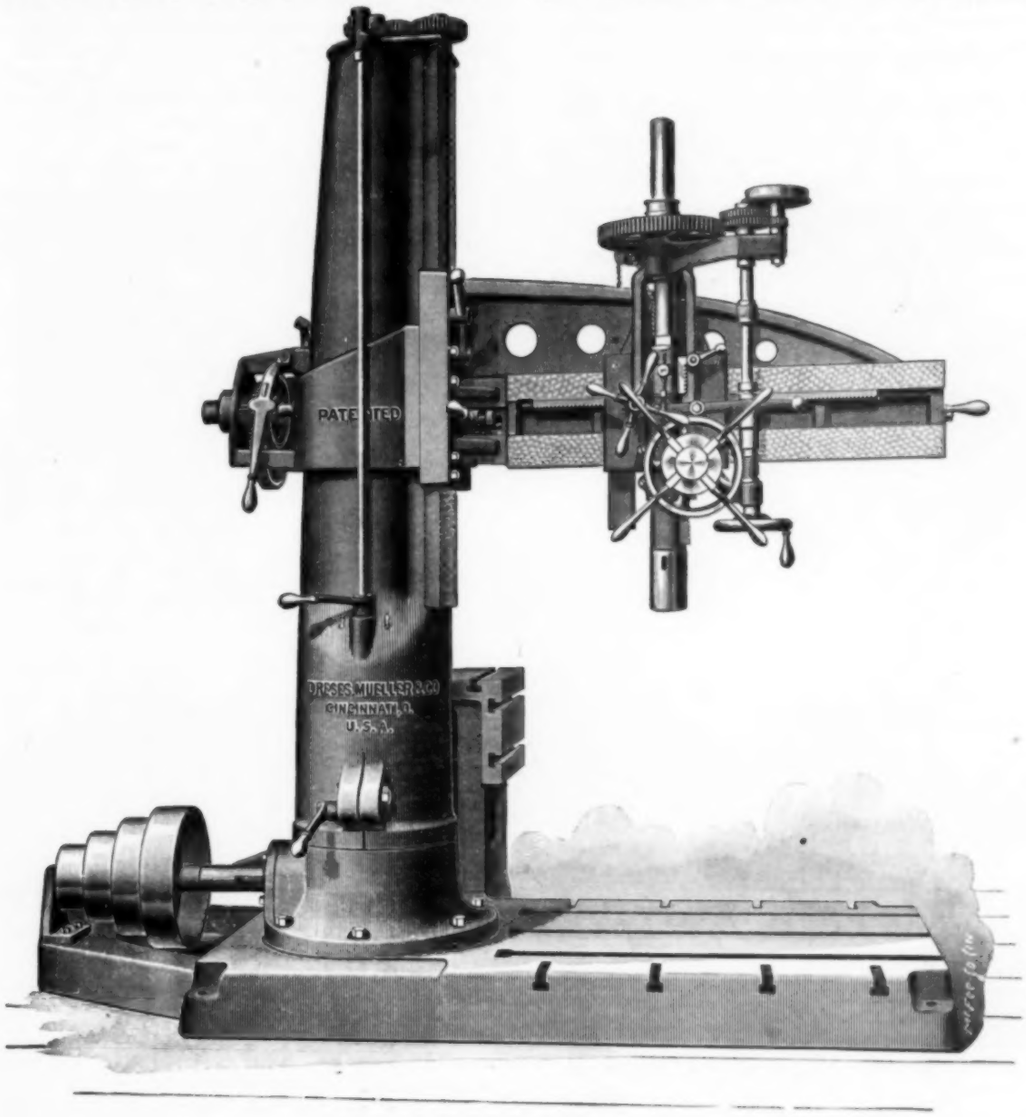
A Suit Over the Proposed Wire Combine.

The expenses of appraisers, expert accountants, attorneys and others who had to do with the negotiations early in the year, that were meant to bring together all the wire rod and wire mills of the country, were known to be very heavy. These and the loss of promoters' profits form the basis of a suit filed at St. Louis, Nov. 22, by Gerrit H. Ten Broek against John W. Gates, of Chicago, and Elbert H. Gary for $1,875,000. The plaintiff alleges that on Sept. 13, 1897, he entered into a contract in writing with Elbert H. Gary, the contract representing that John W. Gates was Mr. Gary's associate. Mr. Ten Broek represented the following persons as his associates: Daniel R Wolfe, George Cook, Benjamin L. Cook J. Gifford Ladd and John H. Parks. The last named will be recalled as the organizer of the wire nail and nut and bolt pools. It was proposed, it is alleged in the petition, to form a corporation to purchase wire rod, barb wire and wire nail manufactories in the United States and elsewhere, the profits to be placed in the hands of J. Pierpont Morgan & Co., as trustees and treasurer, and the gains to be divided into halves, the defendants to have one-half and Ten Broek and his associates the other. The profits and gains agreed on, which were to accrue to the parties, were to be in the shape of stock in a corporation to be formed, representing $3,750,000 capital. The plaintiff, it is further averred, in all respects fulfilled the contract on his part; but the defendants, when the formation of a corporation and purchase by it of the manufactories had been consummated, without the knowledge of plaintiff or his associates and by means of clandestine and secret meetings, formed a corporation and agreed upon a purchase by the corporation of other manufactories, thus preventing the final consummation of the agreement on the part of the plaintiff. The defendants thereby failed and neglected to comply with the terms of the agreement on their part, it is asserted, to the damage of the plaintiff in the sum asked for.

A statement about the suit is made by President Lambert, of the American Steel & Wire Co., to this effect: Mr. Ten Broek was a promoter of the original project for a wire rod and wire nail consolidation. The companies proposed included that in which D. R. Wolfe and others of Mr. Ten Broek's associates were interested. It was finally concluded by J. Pierpont Morgan that there was too much dead wood in the list of companies submitted for the consolidation and the plan fell through. Later Judge Gary, Mr. Gates and others succeeded in floating the American Steel & Wire Co. on lines independent of the original proposition, and Mr. Ten Broek had nothing to do with this movement.

LARGE RADIAL DRILL.

Dreses, Mueller & Co., of Cincinnati, have added to their line of machinery lately the large radial drill shown in the accompanying illustration. The tool is designed to meet the requirements of exacting service, chief among these being that the controlling medium should be always in reach of the operator. For time-saving and tool saving this is of great importance in a radial drill, since in scarcely any other metal-working machine are the speed and position of the working tool changed. This problem the builders of this machine have solved by so designing the driving mechanism that it is controlled by a single lever protruding through the arm near the column. This lever starts, stops, engages the back gears and reverses the spindle quickly for tapping—all while the machine



LARGE RADIAL DRILL.

is running, without resorting to the belt shifter, and without regard to the position in which the arm stands.

The feed is engaged or disengaged by an upward or downward push of the knob above the hand wheel and changed by shifting the knurled collar on the feed rod, this without stopping the machine. The spindle is provided with an automatic stopping device and any one of the four levers of the quick return disengages the clutch. The head is moved on the arm by a rack and pinion. The column is clamped to the stump by one single handle in an instant.

This machine drills to a center of 9 feet, takes 66 inches under the spindle, and the traverse motion of the latter is 15 inches.

STOCKS of iron in the American Pig Iron Storage Warrant Co.'s yards fell to 168,300 tons between Nov. 10 and Nov. 20, 3,100 tons being taken from yard and 800 tons put in, in the interval.

THE COST OF ARMOR PLATE.

The Philadelphia *Press*, referring to the report that "four shipbuilding firms having contracts to construct monitors for the Government have formed a combination to put up prices in case larger vessels are decided upon," says: "Rather than submit to extortion Congress would refuse to authorize the construction of more ships or put a limit on their cost, just as it did in the case of armor plate, for which the Carnegie company and the Bethlehem Iron Works asked an excessive price. They made a large reduction in rates in the end, and the shipbuilders will have to do the same thing. The attempt to impose trust prices on Congress will not succeed."

Referring to the erroneous statement above that the armor plate companies "asked an excessive price," the *Bulletin* of the American Iron and Steel Association comments:

"At no time since our armor plate industry was established, only eight years ago, has the price of armor plates been 'excessive.' At first the price charged per ton was $490 and over, but this price was amply justified because the industry was new and largely experimental, because it had required an immense investment of private capital, because the quantity of armor plate ordered would keep the works in operation only a few months in the year, and because it was exceedingly doubtful whether the Government would ever need any considerable quantity of armor plate. Heavily armored battleships especially were at that time and even until recently regarded as an experiment. Subsequently Secretary Herbert recommended that the average price to be paid should not exceed $400 per ton, but Congress arbitrarily fixed the price at $300. Of course the manufacturers refused to make armor plate at this price, but offered to fill contracts at $425. Secretary

Long, after thorough investigation, recommended that this price be paid, but Congress named $400, and at this price large contracts were made and are now being filled. The manufacture of armor plates has now become an established industry, and being such any business man can see that the present price of $400 may be more satisfactory than the original price of $490 and over, when the industry was nothing but an experiment. No European government is to-day able to buy armor plate at $400 per ton.

"It is a little late in the day for any American newspaper to criticize our armor plate manufacturers for the prices they have charged for armor plate Without their help the wonderful achievements of the American navy in the war with Spain would never have been recorded, for we could not have had a navy that would have dared to meet that of Spain or any other country."

GEAR-CUTTING MACHINE.

Nelson A. Wheeler, of Stockton, Cal., has designed a gear-cutting machine, the construction and operation of which is shown by the cuts herewith. The inventor has aimed at a variety of adjustments so that gear-teeth of various types can be cut, and has made possible a very considerable saving in the cost of a gear pattern. A side elevation of Mr. Wheeler's machine, with part of the gear-wheel pattern in section, is shown in Fig. 1. Fig. 2 is a sectional elevation on the line 8-8 of Fig. 1. Figs. 3 and 4 show specimens of the work the improved machine is capable of doing. The construction is indicated in general by the engravings.

In operation the wood plate or block *i*, which is to form the pattern of the gear-wheel, is first turned to a true cylindrical or conical shape and is placed upon the work-holder C. The yoke *a* and the holder C are so adjusted that a line extending

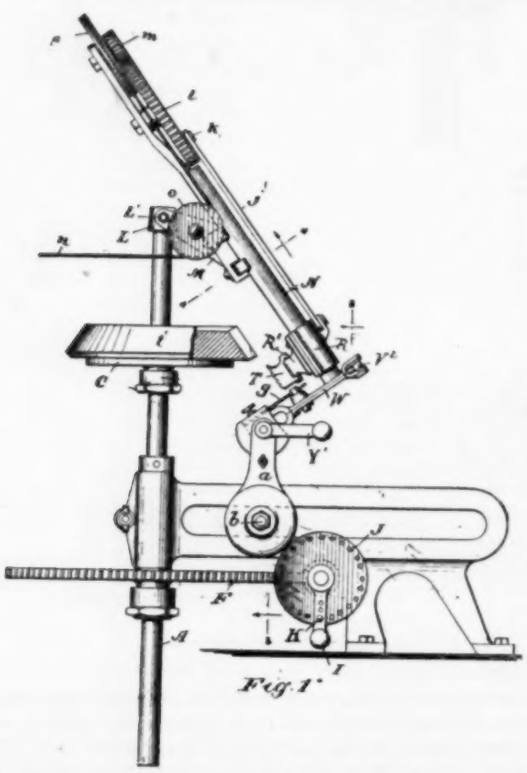


Fig. 1.

from the pivot L' to the working edge of the cutter and to the guiding edge of the templet *g* will coincide with the periphery of the block or blank *i*. A reciprocating motion is then given the cutter in the direction toward and from the pivot L', by means of a connecting-rod *j*, secured to a crank-pin *k* on the gear-wheel *l*, engaging a pinion *m*, which is driven by means of a transmission-rope *n*, passing over pulleys *o* and *p*. During such movement the cutter-guide N remains stationary, and thus the cutter moves in the same path at each stroke. In order to cause the cutter to deviate laterally and at the same time to go deeper into the material, the operator turns the crank Y'. This causes the nuts X on the screw-rod Y (Fig. 2) to move away from each other, thereby drawing the connected ends of the toggle-arms W toward the shaft A, and at the same time causing the guide N, with the cutter T, to take part in such movement, since the guide is pivoted upon the shaft A at L'. Obviously in this manner the cutter will be caused to penetrate deeper into the material. At the same time since the spring *h* keeps the pin U against the guiding edge of the templet *g*, the arm V, and with it the guide N, will be moved sidewise, the shaft A acting as a pivot for such movement, the shaft and the blank *i* remain stationary. Thus the operator by gradually feeding the cutter inward will also move it laterally, so as to reproduce on the blank the exact shape of the tooth which is produced on the templet *g*. When one side of the tooth has thus been cut, the templet *g* is reversed for the purpose of cutting the other side of the tooth, the spring *h* is unhooked and then fastened upon the hook on the other side of the yoke *a*. At the same time the cutter is removed and a similar cutter is inserted with the opposite inclination. In this manner both sides of the tooth will be cut. When one tooth has been completed, the block *i* is given a partial rotation by turning the crank I to the desired extent.

The machine upon which the designer has done experimental work is only a model in size. It weighs about 35 pounds and its range is for bevel gears of any number of teeth, of sizes from 1¼ inch to two feet in diameter. The time required to cut a tooth is from one to two minutes. The form of tooth is not fixed but as the gear-maker forms his templet so is the tooth. The perplexities of making a bevel or miter gear, only to find, after it has been turned over to the molder, that with all his endeavors the result is far from perfect, are a matter of familiar experience to the gear-maker. The ma-

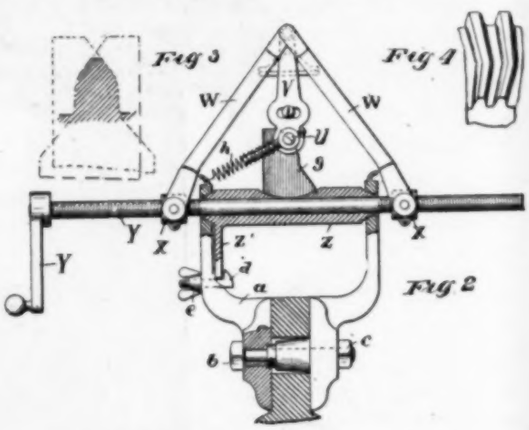


Fig 3 Fig 4 Fig 2

chine illustrated gives teeth that with proper molding will approach cut gears in smoothness, it is claimed, while the full length of the tooth for wearing surface will be insured and strength guaranteed. The machine cuts bevel and skew gears and miters, with straight-angled or curved teeth.

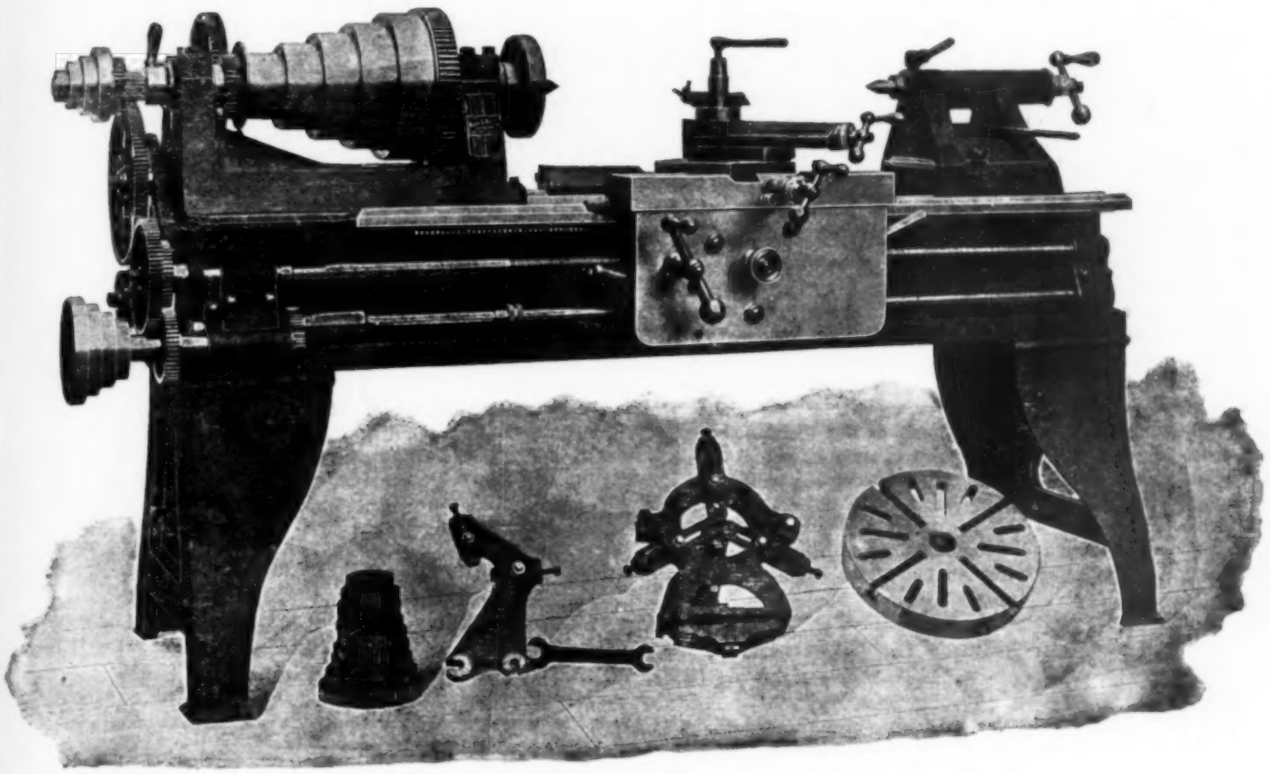
A SUMMARY of the pig iron and cast iron pipe business of Alabama and Tennessee for the 10 months ending Oct. 31 is as follows: Total shipments of pig iron (all to furnaces in Alabama and Tennessee being included), 1,094,442, tons, an increase over the corresponding period of last year of 209,548 tons. Shipments of pig iron from the Birmingham district, 696,392 tons; increase of 103,211 tons. Shipments of cast iron pipe from Alabama and Tennessee, 109,534 tons; an increase of 33,622 tons. Shipments of cast iron pipe from the Birmingham district, 37,880 tons; an increase of 5,778 tons. Shipments of export pig iron from Alabama furnaces, 148,033 tons; an increase of 43,346 tons.

THE I. W. Bollinger Co., at present located at 133 S. Clinton street, Chicago, will remove its office, on Dec. 1, to the Monadnock Block, in order to be nearer the center of trade, and to accommodate its numerous out-of-town customers. The Bollinger Co. represents Wm. Clark Sons Co., of Pittsburg; the Terre Haute Iron & Steel Co., and the Wabash Iron Co., of Terre Haute, Ind., and the McCool Tube Co., of Beaver Falls, Pa. Mr. Bollinger reports having had a very good trade of late, and an excellent demand for the products of all the companies he represents.

IMPROVED ENGINE LATHE.

The engine lathe manufactured by Rahn & Mayer, of Cincinnati, and furnished in 16-inch and 18-inch machines, is illustrated below. Its special features are indicated in the following description: Conveniences are supplied for quick and easy handling of work, and approved material and workmanship are employed in construction.

The spindles are made from high grade special steel, and are ground true. The head spindles are hollow with $1\frac{5}{16}$-inch hole through their entire length. Boxes are of phosphor bronze, and are provided with means for taking up the wear. The driving cones are of large diameter with provisions for broad belts. The carriages have long bearings on the ways with improved devices to prevent their cutting, and can be locked for cross-feed work by a bolt and gib on the carriage. All feeds are adjusted in the apron by a lever convenient to the hand of the operator. This feature does away with complicated gearing often found in headstocks, and obviates the necessity of the operator leaving his position in front of his work. The rack, rack gear and all small feed gear are cut from solid steel. The range of both lateral and cross-feeds



IMPROVED ENGINE LATHE.

is from very fine feeds on tool steel to heavy coarse feeds for roughing-off work. Changes from belt feed to positive gear feed can be quickly made.

These lathes can be furnished with taper attachment, compound rest, rise and fall rest, and turret on carriage. The taper attachment is capable of turning or boring tapers of a large range, and so connected on the back of the carriage that it is always within reach of the operator, and traversing along with the carriage, the operator need not leave his position in front of his work, in order to go to the rear of his lathe to make adjustments for the various lengths of different work to be operated upon. The compound rest is of a new design, and has a long bearing on the cross slide of the carriage. All lead screws are cut from a master screw. The tail stock is heavy, with a long bearing on the shears, and is provided with set-over for taper work.

The front bearing of the 16-inch lathe is $2\frac{1}{2}$ inches diameter and $4\frac{1}{2}$ inches long; the back bearing, $1\frac{7}{8}$ inches diameter and 3 inches long. The nose on the spindle is $2\frac{3}{16}$ inches diameter and 2 inches long. The swing over the carriage is 11 inches, swing over V's, 17 inches; depth of bed, 11 inches; length of beds, 6, 8 and 10 feet. The corresponding dimensions of the 18-inch lathe are, respectively: $2\frac{5}{8}$ inches and 5 inches; 2 inches and $3\frac{1}{2}$ inches; $2\frac{1}{4}$ inches and $2\frac{1}{2}$ inches; 12 inches; 12 inches; $6\frac{1}{2}$, $8\frac{1}{2}$— and $10\frac{1}{2}$ feet.

Electric Motors Under Lease.

One obstacle to the more rapid adoption of electric power, especially in the case of small users everywhere, is undoubtedly the want of capital to purchase the necessary motor, but where the power to purchase exists, the buyer often has little or no experience with electrical matters to guide him in his purchase, and if his means are limited he will naturally be tempted to venture on a cheap line with probably unsatisfactory results. A solution of these difficulties, which has been applied with excellent results at Bradford, England, is the purchase of good, reliable motors, and offering them for hire by the owners of the electricity supply undertakings, who, in this instance, are the municipality itself. According to figures prepared by Mr. Alfred H. Gibbings, the city electrical engineer of Bradford, they have found there that a rental charge of 10 per cent upon the initial cost of each motor was amply sufficient to yield acceptable returns, this charge being made up of three per cent for interest, three per cent for sinking fund, and four per cent for depreciation and contingent expenses. The Bradford Corporation inaugurated their scheme of hiring—in which, by the way, arc lamps also are included on similar terms—in November, 1896, and up to October of this year had supplied 98 motors to consumers. The increase in electricity supplied for motive power in 1896, with only two months of the hire system in force, over that supplied in 1895 was a little over 19,000 Board of Trade units; in 1897 the increased sale over 1896 was ovr 52,000 units, and for this year the increase over 897 will probably be nearly 63,000 units, representing a more than 50 per cent increase. These figures show very strikingly to what extent the facilities offered by the Bradford Corporation are appreciated. Hitherto the supply has been confined to small power uses, such as for cranes, hoists, fans, pumping and similar purposes. More recently, however, applications for motor service have come from a large spinning and weaving firm, several foundries where blowers are to be driven, a saw-mill requiring about 20 horse-power, and an engineering shop requiring about 50 horse-power, all of which indicates growing and gratifying confidence in electric power.—[Cassier's Magazine for December.

All Feed-Water Heaters possess some point of merit or of advantage — but is one just as good as another?

No! Not by a Jug-full!

Each may possess intrinsic merit, but the **Cochrane Heaters** possess a majority of these individual, meritorious features, making them better than any other kind.

A good Heater should purify the boiler feed supply—that is, it should take out mud, carbonates of lime and magnesia, or anything else that remains insoluble or becomes insoluble at the temperature of exhaust steam. Is that all? Not by a jug-full! Where does this stuff lodge or settle? Why, in the Heater, and the removing of it is made easier in the Cochrane Heater than in any other. Big cleaning doors—quickly placed fastenings—removable trays—and the filtering material, with all of its accumulations and deposits, you haul out with a hoe or with a shovel. Can't be simpler, can't be easier. Our catalogues will tell you about some of the other good points.

MANUFACTURERS
Cochrane Heaters and Cochrane Separators.

Harrison Safety Boiler Works,
PHILADELPHIA, PA.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants:—

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

The Cyclone Washing Machine Co., of Battle Creek, Mich., succeeds the firm of Coon Bros. in the manufacture of washing machines, taking over the plant and equipment of the latter. The main building is 48 x 60 feet, three stories. The company will be in the market shortly for emery wheels, and brass and iron castings.

Contracts for the new plant of the Harrisburg (Pa.) Foundry & Machine Works are being let. The main building is to be 300 x 140, some addition being made to the original plan.

The Mather & Ory Co., Manawa, Wis., has been incorporated to do a general machine shop business. The capital stock is $3,500. The officers are D. H. Mather, president; H. E. Shipman, secretary; L. F. Ory, treasurer.

The Abbott Electric Mfg. Co., 74 Frankfort st., Cleveland has been incorporated to manufacture electrical specialties. It will engage also in the production of fine tools and in die work. Some other specialties are contemplated, of which announcement will be made later. The company will be fully equipped to execute orders by Jan. 1. The officers are: Wm. Marbach, president; Chas. S. Abbott, vice-president; A. D. Pettibone, secretary and treasurer; Samuel Abbott, superintendent. Among purchases that will be made are small punching presses and a nickel-plating outfit.

W. Thornton, 508 Market st., Chattanooga, Tenn., is reported as a prospective buyer of a 25-h. p. gas engine and of a turret lathe.

New Construction:—

Jones & Laughlins, Ltd., of Pittsburg, have been making large expenditures in the past year or two, tearing out old plant and putting in new; adding new ore yards and providing greater furnace and steel mill capacity. It is now announced that a block of land on which are more than a score of houses has just been acquired at $125,000 approximately, and that the buildings will be torn down and new plant erected. The Pittsburg *Dispatch* says: "Jones & Laughlins' land holdings on the South Side now include all the ground between 26th and 30th streets, Carson street and the Monongahela River. It is reported that several deals are in progress for the purchase of other land in the vicinity of the plant. Willis L. King, general manager of the company, stated that the purchases already made were in line with the general plans of the company, which were formed with the end in view of accommodating the plant's productive capacity to the heavy and increasing demands made upon it."

The Linham Column & Baluster Co., of Mansfield, O., will erect at St. Albans, W. Va., a building 100 x 47 feet, which will be equipped with special machinery for the manufacture of porch columns, balusters, etc. The company has purchased from the Mansfield Display Novelty Co., of Mansfield, O., machinery rights and good will. This machinery has been developed as the result of a large amount of experimental work.

The Berlin Iron Bridge Co., of East Berlin, Conn., is erecting for the Waterbury Mfg. Co., Waterbury, Conn., a new blacksmith shop two stories high, 40 x 40 feet. The building is to be of fireproof construction throughout. The floor consists of concrete on corrugated iron arches, carried by steel beams and columns. The roof has steel trusses supporting the covering of corrugated iron lined with the Berlin Iron Bridge Co.'s patent anti-condensation lining.

The new foundry at Ellwood City is to be operated by E. J. O. Davidson and Scott Coates, lately with the Derwent Foundry Co. The main foundry is 50 x 85 feet, one story high, and there are additional buildings for pattern shop, machine shop, sand sheds, core ovens, coke house, etc. The new company will make castings for gas engines and a general line of machinery castings.

The second building in the Michigan Malleable Iron Co.'s new plant at Delray was started up last week, and further additions to the working force will be made from time to time. At its full capacity the plant will employ 800 men.

The Q & C Shop Saws

Cut Everything. - - - -

No. 1. Capacity, 4 inches.
No. 2. " 5 "
No. 4. " 8 "
No. 8. " 3x12 "

POWER SAWING MACHINES

For all purposes.

THE Q AND C

Chicago. New York.

Send for Catalogue.

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO,

Proprietors of the CELEBRATED Mount Savage Fire Brick

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OTIS STEEL

"OTIS" FIRE-BOX PLATES A SPECIALTY.

Flange Plates, Ship Plates, Tank Plates, Steel Car Axles and Forgings of all kinds.

Steel Castings from 100 to 75,000 lbs.

Head Office and Works, CLEVELAND, OHIO.

Agencies: NEW YORK, 97 Cedar St. CHICAGO, Old Colony Bldg.
ST. LOUIS, 516 N. Third St. WASHINGTON, Kellogg Bldg.
MONTREAL, Homer Taylor, 183 St. James St.
SAN FRANCISCO, John Woodlock, 154-156 First St.

Conestoga Building, EDWARD E. ERIKSON, PITTSBURG, PA.

Regenerative Gas Furnaces and Water Seal Gas Producers.

Producer Gas under Tubular Boilers, saving 20 per cent in fuel. NO SMOKE.

The A B C of Iron, Now 81.

There are nine double annealing ovens of 10-tons capacity each. The old plant will not be shut down, but will be operated by a recently formed company, in which the members of the malleable company are interested.

Bids are being received on a two-story brick and iron shop building 100 x 170 feet, for the Baldwin Locomotive Works, Philadelphia.

Work started this week on a storage house, boiler house and additional foundry room at the plant of the Pennsylvania Car Wheel Co., Allegheny, Pa.

Advices from Irondale, O., are that in case the tin plate plant there is shut down or removed, another will be built in which Wm. Banfield and others will be interested.

The Alabama Steel & Wire Co. has awarded contract to Meighan & Co., for the erection of its machine shop, 60 x 120 feet.

The United States Water & Steam Supply Co., Kansas City, Mo., will erect an additional machine shop.

Chess Bros., proprietors of the Central Expanded Metal Co., Pittsburg, will enlarge their expanded metal works at Braddock, Pa., expending about $20,000.

The Allegheny (Pa.) Heating Co. is building what is claimed will be the largest gas holder in the world, the purpose being to steady the supply of natural gas against the daily fluctuations in consumption. The holder will have a capacity of 5,000,000 cubic feet, and will be 198 feet high and 216 feet 1 inch high. It is being built by the Riter-Conley Mfg. Co., Pittsburg.

The large addition to the plant of the Sidney Novelty Co., Sidney, N. Y., is enclosed and a 250 h. p. engine has been purchased. It is proposed to increase the capital from $21,000 to $100,000.

To take the place of the plant recently burned the Standard Car Wheel Co., of Cleveland, will put up a new building 140 x 200 feet. The equipment will include boilers, pumps, engine, etc.

Fires and Accidents:—

Metal from a reverberatory furnace ran out, at the Belle City Malleable Iron Co.'s works at Racine, Wis., and the molding and machine departments were entirely destroyed. The loss is about $40,000; insured. It is expected to rebuild at once. The annealing, blacksmith, office and pattern buildings were saved.

Fire destroyed the plant of the Garrettsville Foundry & Machine Co., Garrettsville, O., Nov. 24. Loss $6,000.

Fire caused a loss of $2,000 at the foundry of Jackson, Church & Co., Saginaw, Mich., Nov. 23.

At Bryan, Tex., Nov. 25, fire destroyed the Chatham Machine Co.'s plant. Insured.

Fire in the shipyard of John H. Starin, at West New Brighton, S. I., Nov. 19, caused a loss of nearly $400,000 on machine shops, boiler works, carpenter shop, repair shops and offices. Dry docks and steamers were saved.

General Industrial Notes:—

The Rankin Station, Pa., plant of the American Steel & Wire Co. reports an output of 839,320 pounds of No. 5 wire rods on Thursday, Nov. 24, and 825,770 pounds on Nov. 25. The wire outputs were 762,570 pounds and 729,300 pounds respectively for the two days. At the Oliver Wire Co.'s rod mill, South Side, Pittsburg, the output for seven consecutive turns averaged over 200 tons a turn recently: Nov. 16, day turn, 440,610 pounds; Nov. 16, night turn, 456,380 pounds; Nov. 17, day turn, 473,480 pounds; Nov. 17, night turn, 466,050 pounds; Nov. 18, day turn, 426,370 pounds; Nov. 18, night turn, 403,740 pounds; Nov. 19, day turn, 407,220 pounds. Total, 3,073,850 pounds for the seven turns, an average of 439,121⅛ pounds.

It is reported that $11,000,000 is the proposed capital of the elevator manufacturers' combine and that all the companies whose plants are to be acquired have agreed to dispose of their properties.

Contracts involving the expenditure of about $100,000 have been let by the Westinghouse Air Brake Co. for the machinery to be installed in the concern's new plant at St. Petersburg, Russia. The Westinghouse-Church-Kerr Co., Manning, Maxwell & Moore, the Bullard Machine Co. and F. E. Reed & Co. secured the business. The first work of the new plant will be on $5,000,000 worth of air brakes and other equipment for the Trans-Siberian railway.

The Cambria Iron Co., of Johnstown, Pa., is adding 100 new ovens to its by-product coke oven plant.

The Home Iron Co., Bristol, Tenn., announces that its Bris-

U. BAIRD MACHINERY CO.,

123-125 Water St., **PITTSBURG, PA.,** 124-126 First Ave.

Machine Tools and Supplies. Send for list of Second-hand Tools.

BRASS

Founders and Finishers.

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PROCESS.

(Cupola metal.) Government tests 36,000 to 49,000 tens. strength.

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1522 Monadnock, Chicago.

RECEIVERS' SALE OF WELDLESS STEEL TUBING, MADE UNDER THE KELLOGG PATENTS. STOCK LIST AND PRICES FURNISHED UPON APPLICATION.

E. D. NICKERSON,

Receiver, Findlay, O.

A firm needing a certain line of goods naturally turns first to those it has seen oftenest advertised, and with whose name it thus has become familiar. "Keeping everlastingly at it brings success."

Small Seamless Brass

TUBING

1-32 to 1-2 inch in diameter—any gauge.

SEND FOR QUOTATIONS.

WM. S. SPOFFORD & SON,

Providence, R. I., U. S. A

Advertise in The Iron Trade Review. It will pay you.

PUNCHES AND SHEARS

OF ALL KINDS

MANUFACTURED BY

The Long & Allstatter Co.,

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Send for catalogue.

SHENANGO VALLEY STEEL CO., New Castle, Pa.,

MANUFACTURERS OF

Bessemer Pig Iron, Steel Billets, Blooms, Black Plate, Tin Plate, Tin Plate Bars, Wire Rods, Market Wire and Wire Nails.

tol Furnace will be put in blast if satisfactory freight rates can be secured.

The Thomas Furnace Co., of Niles, O., has been incorporated at Columbus, O. Capital, $100,000. Incorporators: John M. Thomas, W. Aubrey Thomas, Patrick Sheehan and William H. Otterman.

The Western Iron & Steel Co., whose rolling mill is at Lake View, Washington, near Tacoma, is making twice as large an output as at the same time last year, and is talking of a tidewater site.

Blasting to remove salamander at Furnace C, Sparrow's Point, Md., damaged the stack to such an extent that brick work will have to be relaid. The work is now going on.

Two large blowing engines will be added to the equipment of the Carrie Furnaces of the Carnegie Steel Co., Ltd. They are vertical cross-compound engines, with high and low pressure steam valves. The air cylinders are 60 x 80 inches. The flywheels are 24 feet in diameter and weigh 100,000 pounds.

The Kelly Nail & Iron Co., Ironton, O., is installing wire nail machines and will be in the market as a maker of wire nails of all kinds about the first of the year. The supply of wire will be obtained from the new wire rod and wire mill the Ashland Steel Co., Ashland, Ky., is building, across the river from Ironton. The stock from the Ashland plant as furnished to the Ironton mill is ⅜ inch in diameter. Forty wire nail machines will occupy the space formerly given to 57 cut nail machines. An annealing furnace is being built and a pickling house.

The property of the Toledo Drop Forge Co. has been sold to the C. C. Wormer Machine Co., of Detroit, the consideration being $16,000. The Security Trust Co. made the sale.

Creditors have asked an investigation of the failure of the Architectural Iron Works, of Cincinnati. Some material has been replevined. The representation of the company that it was worth $40,000 above its debts is the basis of the investigation.

The American Galvanizing Works of W. T. Simpson & Co., Cincinnati, have been taken over by the American Galvanizing & Tin Plate Co., the incorporators being the old partners.

The Dover Fire Brick Co., Cleveland, has its works at Canal Dover and Strasburg, O., running to full capacity. The company received an order recently from the Lorain Steel Co., Lorain, O., for 150,000 brick to be used in the construction of its new blooming mill.

The Morton Mfg. Co., of Muskegon, Mich., has a number of European contracts for ship and engine building tools. Among other orders is one from John Brown & Co., of Sheffield, for a shaper to weigh from 16 to 20 tons. It is to be used for planing armor plate and other work of exceptional size.

The two mills which have been added to the four-mill plant of the Humbert Tin Plate Co. at South Connellsville, Pa., were expected to be completed and be put in operation this week.

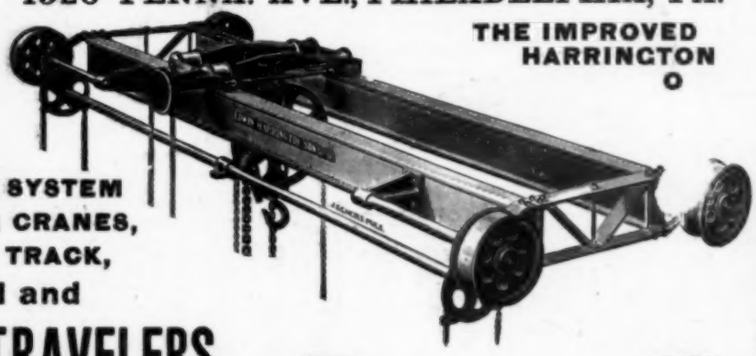
The Totten & Hogg Iron & Steel Foundry Co., Pittsburg, has received an order from the Cumberland (Md.) Steel & Tin Plate Co. to furnish a shear to cut up old locomotive tires.

EDWIN HARRINGTON, SON & CO., Inc.,

DESIGNERS AND MANUFACTURERS OF

ENGINE LATHES, DRILLS, MILLING MACHINES, Etc.

1526 PENNA. AVE., PHILADELPHIA, PA.



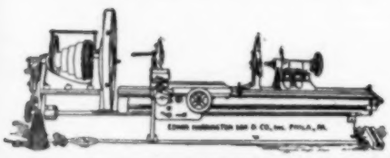
THE IMPROVED HARRINGTON

COMPLETE SYSTEM TRAVELING CRANES, OVERHEAD TRACK, Geared and

PLAIN TRAVELERS,

TURN TABLES and SWITCHES.

OUR NEW ELECTRIC HOIST WORKS LIKE A CHARM.



MADE IN PHILA. ONLY.

On account of the size and hardness of the material a very strong shear is required, and the shear to be furnished will have a capacity to cut 4½-inch rounds, cold, of .60 carbon steel. The company recently finished a shear for the same purpose for the Canton (O.) Steel Co. Each shear weighs about 90,000 pounds.

The B. & O. receivers have given the Schoen Pressed Steel Co., of Allegheny, Pa., an order for 1,000 pressed steel cars, with a capacity of 50 net tons each. They have also ordered 50 additional consolidated locomotives, cylinders 22 x 28.

An evidently unfounded rumor has it that the new consolidated tin plate company will erect a tin plate plant at Mingo Junction, adjoining the steel works and bar mill of the Ætna-Standard Iron & Steel Co., of Bridgeport, O. It may possibly be the intention to remove the tin mills of the Ætna-Standard Iron & Steel Co., which have been purchased, from their present location in connection with the sheet and other mills of the Ætna-Standard at Bridgeport, to Mingo Junction. Their operation in their present locations, by an outside company, would be inconvenient.

The Stowell Mfg. & Foundry Co., South Milwaukee, Wis., will have its new malleable foundry running early in December. It will have a capacity of about six tons a day, paying special attention to small work. A. W. Wagner will have charge of the malleable department.

The Eagle Iron & Steel Co., Ironton, O., is building a new furnace for the bar mill which will increase the capacity of finished bars about one-half.

The Oriskany Malleable Iron Co., Utica, N. Y., has elected Geo. A. Baer president, John B. Whitten vice-president and Geo. H. Graham secretary and treasurer. The other directors just elected are Samuel Nelson and W. W. Sink.

The Jackson & Church Co., of Saginaw, Mich., just incorporated, will succeed the Jackson & Church partnership. The capital stock is $75,000, all paid in. The machine shop, foundry and boiler worksbusiness is now all under one management.

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The Toledo Machine & Tool Co., Toledo, O., has not definitely decided concerning new quarters, but there are negotiations for the Yost plant.

The Mesta Machine Co., Pittsburg, which succeeds, Dec. 1, to the Robinson-Rea Mfg. Co. and the Leechburg Foundry & Machine Co., will erect an additional plant near Homestead, Pa. A tract of 8½ acres, with excellent rail and water shipping facilities, has been purchased. There will be a steel foundry, roll and machine foundry and ingot mold foundry. The main foundry building will be over 800 feet long. There will be a machine shop adjoining, about 600 feet long. When the steel foundry is completed the department for making machine molded gears will be removed from Leechburg to Homestead, to permit of making gears of steel as well as iron.

It is now announced that the Schoen Pressed Steel Co., Pittsburg, is planning to remove its plant from Allegheny to a point a short distance up the Monongahela River, before the extensive improvements recently referred to are made. The Allegheny plant will soon have a capacity of 40 steel cars a day, and the new plant is expected ultimately to have a capacity for 75 cars a day. The change is made to secure better facilities, especially nearness to mills producing the raw material.

At the recent session of the Michigan Political Science Association at Albion, Mich., the new plant of the Albion Malleable Iron Co. and that of the Gale Mfg. Co. were inspected. The new malleable company will employ 275 men and will have a capacity of 3,000 tons a year.

Improved Metallurgical Furnaces.

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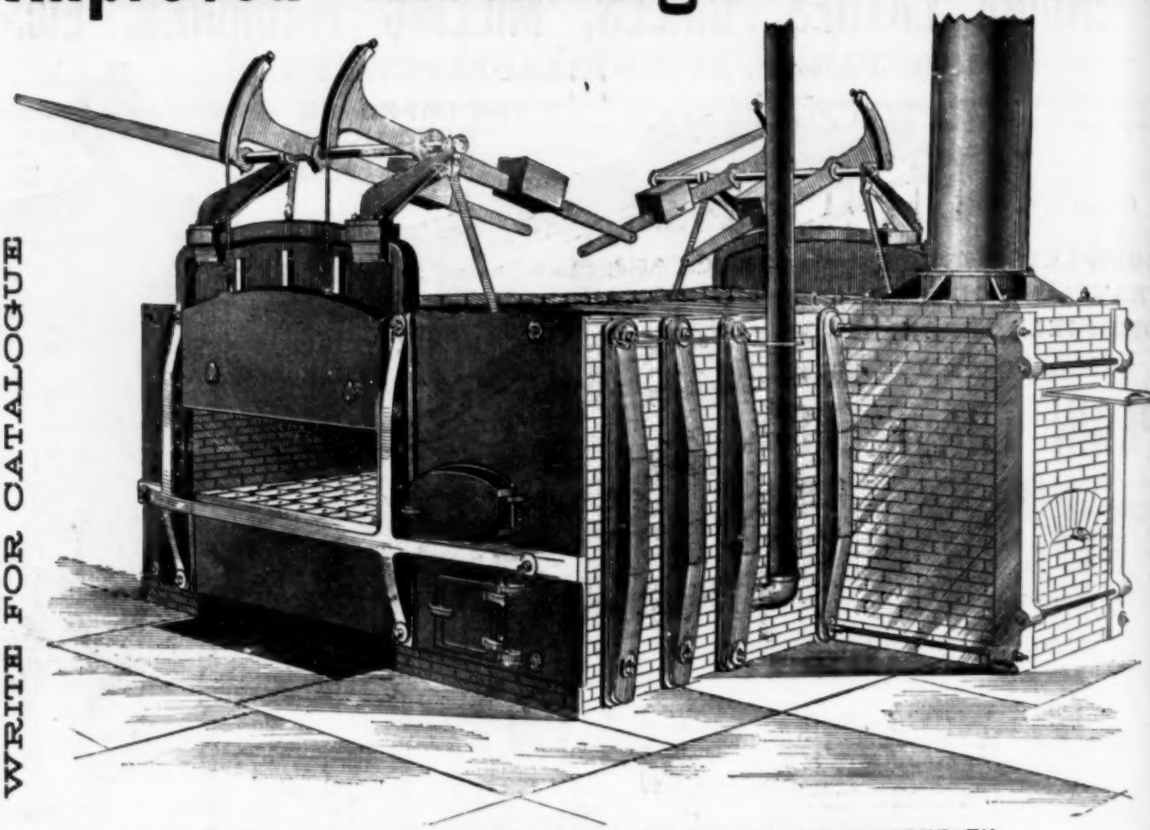

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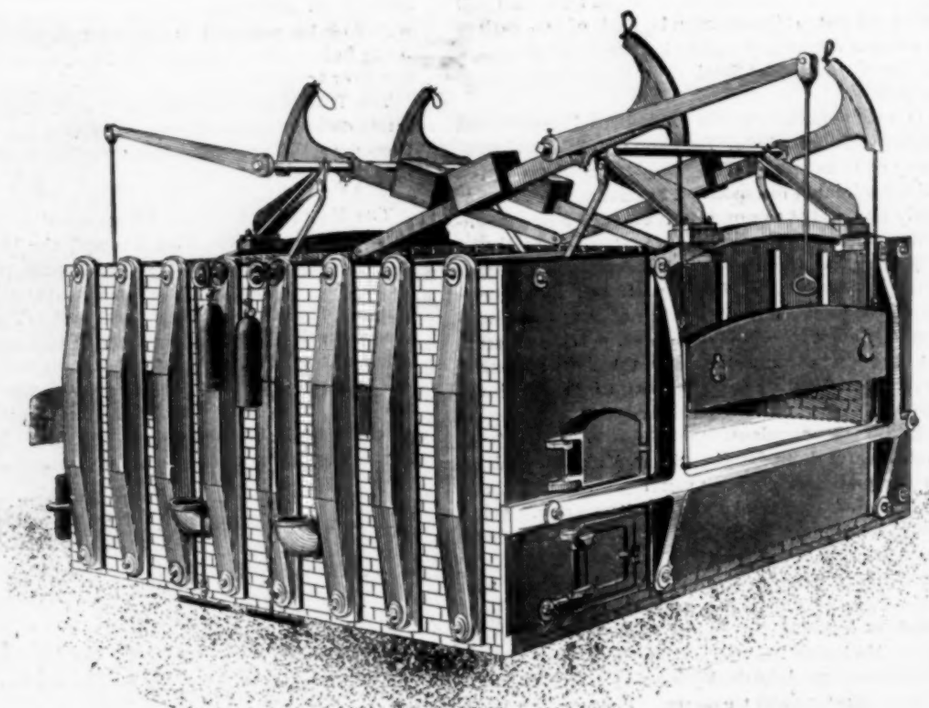

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